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A STUDY OF THE COMPARATIVE VALUES OF THE ORAL AND INTRAVENOUS METHODS OF GALL-BLADDER VISUALIZATION*

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As soon as intravenous gall-bladder visualization became an established method of clinical examination, there were many investigators who began casting about for a more favorable and yet reliable method of administration. Consequently, the oral, rectal and intraduodenal methods have been consistently tried with the resultant survival of only two as a routine procedure, namely, the oral and the intravenous methods.

There are many who, for various reasons, do not wish to use the intravenous method, and while they admit the possible superiority of this method, still feel that, for practical purposes, the oral route of administration quite satisfies their purposes. This investigation was begun in the hope that I might supply to the champions of the oral method, principally, accurate figures as to just what percentage of error they need expect from this particular procedure.

It is self-evident, at the onset, that the chief bone of contention is the question of absorption of the dye from the intestinal tract. In the intravenous method, of course, there is no question that the dye is already in the circulation and the problems of elimination by the liver and concentration by the gall-bladder are the only ones which confront one as far as the physiology of the test is concerned.

I determined to run a series of visualizations by the oral method and subsequently to persuade all those who failed to show a visualized gall-bladder to submit to the intravenous method at a later examination. These examinations have extended over a period of eight months and, without exception, I have been able to carry out the program as outlined. The only disappointment is the small number of cases which we have been able to examine, since in the beginning I had hoped to have a series of at least 50 cases, but find that 30 cases are all that I have been able to collect.

The technic for the oral cases has been the simplest which we could devise. Four and one-half grams of sodium tetraiodophenolphthalein were administered in plain capsules after supper on the day before the x-ray examination. For convenience, the 4.5 grams were placed in 10 gelatin capsules with directions to take 2 every fifteen minutes until all had been taken. The first films were taken twenty-two hours following the administration of the drug, followed by a fat meal and films again in one hour.

For the intravenous method, 2.5 grams of sodium tetraphenoliodophthalein were administered by the gravity method at 9 a. m. The patients came fasting and films were taken seven hours afterward, followed by a fat meal and subsequent films taken in one hour. The dye was dissolved in 50 c. c. of freshly distilled water and preceded and also followed by from 25 to 100 c. c. of normal saline, allowing about twenty minutes for the whole injection. Very few reactions were encountered; in fact, only three cases complained of mild urticaria. However, a somewhat larger number suffered from an inflammation of the veins or a thrombophlebitis. No sloughs were encountered, although some of the dye escaped into the tissue in one case.

The original intention was to report only cases which absolutely failed to visualize by the oral method and to report with simple mathematical accuracy the actual percentage of these which finally visualized by the intravenous method. If this be done, the series of cases would be reduced to 22, the actual number of failures by the oral method being 3, or 13.6 per cent. There are, however, 8 other cases, includ-

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ing one in which a large gallstone was seen, which were so poorly visualized orally that it was deemed wise to repeat them by the intravenous method. In this series of 8 cases, for all practical purposes, the oral visualization was as efficient from a standpoint of diagnosis as was the intravenous. Therefore, I feel that they should be included. If they are included, the figures are as follows:

Total number of cases	30
Total number of cases failing to visualize by the oral method	22
Total number of cases failing to visualize by the intravenous method	19
Total number of cases visualized poorly by both methods	8
Total number of cases visualized by the intravenous method which were not visualized by the oral method	3

Percentage of apparent superiority of the intravenous method equals 10 per cent.

From a purely mathematical standpoint, it seems apparent that the error to be expected by the oral method is, therefore, somewhere between 10 and 13.6 per cent.

After pondering over these figures for some time, it occurred to me that in order to be perfectly fair with the oral method, it might be advisable to select from our former files 30 cases which had failed to visualize on the first attempt and which had been repeated by the oral route. Therefore, 30 cases were selected in rotation, and it was found that 11 out of the 30 which had failed at the first attempt showed a positive shadow on the second attempt. Viewing these results with a cool and calculating eye, it would seem, then, that on the second attempt the oral method had bettered its average by a full 36.6 per cent. However, on closer examination of our records, it was found that the first visualizations had been done with one of the new commercial preparations designed to prevent nausea, and that the second ones had been done with plain capsules. In the light of this discovery, then, these latter thirty cases represent a comparison between the results obtained by first using a commercial dye preparation (which contained much less than 4 grams of the iodeikon) and subsequently using 4.5 grams of iodeikon in plain capsules. Nevertheless, I do not feel that these results can be discounted and would venture the opinion that by repeating our examinations, using plenty of iodeikon in plain capsules in both instances, our error could be reduced substantially below 10 per cent.

This report was not originally intended to compare the clinical values of the two methods, but I feel that it would not be entirely complete without mention of the clinical diagnosis, other x-ray findings and end results of some of the cases. Taking the whole 30 cases into consideration, the diagnosis made was as follows:

Definite chronic cholecystitis	17
Gallstones	2
Suspicious chronic cholecystitis	6
Definite chronic appendicitis	4
Questionable chronic appendicitis	1
Definite duodenal ulcer	4
Questionable duodenal ulcer	2
Ptosis with no adhesions	1
Chronic constipation without organic basis	1
Toxic thyroid	1

In the group which failed to visualize by both methods, the diagnosis was made as follows:

Definite chronic cholecystitis	13
Questionable chronic cholecystitis	4
Definite duodenal ulcer	3
Questionable duodenal ulcer	1
Definite chronic appendicitis	4
Gallstones	1

Gastrointestinal x-ray series of the whole 30 cases resulted in the following figures:

Definite adhesions in the right side of the abdomen	20
Right lower quadrant adhesions	4
Right upper quadrant adhesions	13
Undifferentiated right-sided adhesions	3
No adhesions	8
No series performed	1

One case which failed to visualize by both methods was operated upon and a duodenal ulcer was found. Inspection of the gall-bladder at this time revealed nothing abnormal about the walls and the viscus emptied with slight pressure. The one case in which a diagnosis of toxic thyroid was made had a thyroidectomy. No abdominal operation was done.

The question has often arisen as to whether the degree of gastric acidity has any bearing on the success or failure of the visualization by increasing or preventing the absorption of the dye. Frankly, I should say that it did not have any important bearing upon the absorption. Gastric analysis was performed upon all except 3 of the whole series and we have recorded secretions ranging all the way from complete achylia in one case up to a free acid content of 96 in another. It is interesting to note that both of these cases failed to visualize by both methods. Throughout the whole range of acidities we have been unable to discover any consistent relation between the gastric acidity and either success or failure of the oral method.

In summing up the x-ray findings by glancing back over the gastrointestinal series and visualizations, it seems to me that the 20 cases which

showed adhesions in the right side of the abdomen correspond pleasingly well with the 19 cases which failed to visualize by both oral and intravenous methods. More than this, the 13 cases which were diagnosed as right upper quadrant adhesions by x-ray correspond exactly with the diagnosis of chronic cholecystitis which was made clinically in 13 cases which failed to visualize by both methods. This is only of passing interest, however, and serves only to confirm our confidence in the gastrointestinal series as a method of diagnosing gall-bladder disease by means of x-ray. This, by the way, was almost our only reliable means a few years ago.

Of course, my series of 30 cases is entirely too small. I should have at least 100 cases and in the future expect to have this number. However, while admitting the visualizing superiority of the intravenous method, I have tried to stimulate an added degree of confidence in the oral method by reducing to exact figures the error which may be normally expected. Unfortunately, I have not been able to do this, in a strict literal sense. In other words, there is still some room for difference of opinion. The patients themselves are about evenly divided as to the method which they prefer. Some dislike the intravenous procedure more than they dread the nausea occasioned by the oral method. Others prefer the intravenous method. While I myself prefer the intravenous method, I still feel that by repeating the oral test with a sufficient dose of tetraiodophenolphthalein, the error can be reduced substantially below 10 per cent and possibly as low as 5 per cent. This investigation has impressed upon me most emphatically what some one has said about medicine's still being an art as well as a science. As long as we have mechanical means of medical diagnosis, we shall always seek to improve them, but I feel that after one series of 100 cases has been completed at some future date, we shall be increasingly better satisfied with the oral method of gall-bladder visualization.

DISCUSSION (*Abstract*)

Dr. Howard E. Ashbury, Baltimore, Md.—No single diagnostic procedure has done more to advance our knowledge of biliary disease than cholecystography, and to Dr. Evarts Graham and his associates we owe most credit. Thanks to numerous contributions by others, cholecystography is an established test for gall-bladder function, the accuracy of which is being rapidly improved by experience. There are, naturally, advocates of both methods of administration of the dye for obvious reasons. Dr. Wright has approached the subject unbiasedly from a mathematical angle and his conclusions should be of great interest to gastroenterologists and radiologists in the selection of a method of administration of the dye when for some reason the intravenous method is impracticable. In administering the dye as much care should be used in regulating the technic for the oral method as for the intravenous method, and in both methods too much attention cannot be given to the radiographic details, since the interpretation of a poor roentgenogram is as difficult for one method as the other. In my experience I have found very little difference in the two methods. I use the oral method for patients at my office and the intravenous method in hospital practice, and sometimes to check the oral method.

Dr. Wright's comparison of the use of iodeikon with other commercial preparations brings out an important point, that the dose is of great importance, and should be in proportion to the body weight no matter what the preparation used. Most of the failures in the past have been due to the use of insufficient dye; and lack of absorption in the intestinal tract frequently due to functional or organic pyloric obstruction. For that reason I have devised a technic combining the gastrointestinal and gall-bladder examination, visualizing the gall-bladder at the time of the twenty-four hour intestinal examination by the oral method, and if the visualization is unsatisfactory, one should repeat the test, while there is still some of the dye in circulation. If the hepatic flexure of the colon interferes with visualization of the gall-bladder, which is unusual, the colon is cleaned out by a soap suds enema.

Three hundred of my private patients have been examined in this way. In 30 cases the gall-bladder failed to fill and 25 were poorly visualized, indicating impairment of function. These cases were rechecked orally by a second dose immediately and the best film of the two sets was used for interpretation. The roentgen impressions of the 55 cases were as follows:

Chronic cholecystitis	10
Cholelithiasis	12
Suspicious cholecystitis characterized by poor persistence of the shadow for 38 hours	10
Right-sided abdominal adhesions	14
Duodenal ulcer	1
Gastric ulcer	2
Chronic appendicitis	6
Total	55

Present clinical results as determined by the reports from the physicians who referred the cases were:

Verified by operation		19 cases
Gallstones	12	
Gall-bladders visualized	5	
Gall-bladders not visualized	7	
Chronic cholecystitis	5	
Pericholecystitis	2	
Visualization after non-surgical drainage (Lyon's)		3
Visualization after being stripped by surgeon		1
Patients having subsequent gall-bladder attacks not operated upon		9
Inoperable (myocarditis, anemia, diabetes, carcinoma)		4
Suspicious cholecystitis still under medical care not demanding operation		10
Under medical treatment for peptic ulcer		3
Refused operation		6

The above results, I think, demonstrate with fair accuracy the necessity of visualizing the gall-bladder in conjunction with gastrointestinal examination. Gastric acidity seems not to influence visualization. In fact, cases of achlorhydria which did not visualize by either method are reported.

As a liver functional test, of course, the intravenous method is necessary. Some one has pointed out that

the presence or absence of the dye in the colon is an indication of liver function and patency of the bile ducts. Neither method is necessary in the presence of jaundice.

Finally, the two methods of administration are equally useful in the hands of those who have developed a technic which has been carefully worked out. One can always check by the intravenous method. It seems that the oral method is more popular in America in spite of the fact that the intravenous is a little more reliable. Dr. Wright has demonstrated that advocates of the intravenous method need have no hesitancy in using the oral method when necessary.

Dr. L. P. Gay, St. Louis, Mo.—Some four or five years ago Dr. Sherwood Moore and I discussed this subject before this Section, and as yet we have had no reason to change our opinion. In my office I use both methods, the intravenous and the oral, depending largely upon the patient. If I have a heavy patient on whom it is difficult to get clear x-ray plates, I prefer the intravenous method. Otherwise I use the oral administration and later, if there is any doubt, employ the intravenous method when they go to the hospital for operation. I think the choice is largely a matter of personal preference and agree with Dr. Wright that the oral method is practically as effective as the intravenous.

Dr. N. S. Stern, Memphis, Tenn.—I should like to ask Dr. Wright how many patients he examined altogether during the period of eight months.

Dr. Wright.—We had 105 cases from one particular series during that period.

Dr. Stern.—Out of that 105, 30 did not visualize. Under those circumstances you would have 30 cases without visualization and three cases which were subsequently visualized by intravenous injection. You state that in your other cases there was reduction in non-visualization by one-third, 33 1-3 per cent approximately, upon restudy by the oral method. If these 30 had been re-x-rayed and restudied it would have reduced your cases that could later have been visualized by intravenous injection approximately to two. If you had over 100 cases to start with, your percentage of error would have been about 2 per cent. Any method of examination that comes within 2 per cent of accuracy is satisfactory and is worth following.

Dr. A. L. Levin, New Orleans, La.—If the gall-bladder is poorly visualized or there is no visualization at all, the radiologist should ascertain from the patient how long the dye was retained in the intestinal tract. If the patient vomited the dye shortly after taking it or evacuation of bowels followed soon after administration of the dye, one would not expect to find much evidence of absorption of the dye. I often advise the patient to take 30 minims of paregoric one hour before the dye is taken and repeat the same dose one-half hour later. That helps to keep the dye within the intestinal tract.

Dr. Wright (*closing*).—Our series of cases is entirely too small, but I am sure you appreciate the difficulty of persuading patients who have had the oral method to come back and have the examination repeated by the intravenous method. These cases were selected from the practice of Dr. E. B. Freeman and do not include all the gall-bladder visualizations that we have made. Without his helpful persuasion, this investigation would have been impossible. I am willing to admit that the proper procedure for carrying out an investigation of this kind would be to visualize a patient twice by the oral method and subsequently by the intravenous method, but I have not the heart to ask them to go through such an arduous procedure.

I do not think it is quite fair to use the percentages of the series of cases that have been done by the oral method twice, for at that time the dose of iodeikon used was quite inadequate. I did not mention paregoric, but feel that it is valuable for retaining the dye in the gastrointestinal tract whenever the oral method is used.

There are two things I wish to emphasize and leave with you: first, the close association between the diagnosis of right upper quadrant adhesions as revealed by the gastrointestinal series and the diagnosis of gall-bladder disease as revealed by gall-bladder visualization. Secondly, I wish to leave this thought with you: if for any reason you have a patient who is physically unable to go through the intravenous method, you need not feel that you are losing much of the usefulness of the test by doing it orally.

ETIOLOGY OF ACRODYNIA: REPORT OF THREE CASES*

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Acrodynia, pink disease or erythredema are the usual names given to this relatively common disease. In America, Weston[1] deserves the credit of first classifying the symptoms into a clinical entity under the name used in this article. Since his first paper there have been several authors who have written upon the subject at length, chief among whom is Bilderback,[2] who is largely responsible for presenting the original American paper. The former writer has reviewed the literature from a historical standpoint, while the latter has described the symptoms and course of the malady. The six P's which were described by Bilderback are familiar to most of us and will bear repeating: pain, pink hands and feet, peeling, prostration, paresthesia, and perspiration. To this I would add a seventh, not merely for good luck, but because it is universal with this condition, photophobia. Perionichia is present in the advanced cases.

The announcement of Noguchi,[3] of the Rockefeller Foundation, that he had discovered the causative factor of trachoma, which was a specific microorganism, should stimulate the search for the etiological cause of acrodynia, since trachoma was long thought to be a food deficiency disease. This question is yet unsettled.

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*From the Children's Hospital of Philadelphia and Department of Pediatrics, University of Pennsylvania.

There are two views regarding the etiology of acrodynia: (1) it is caused by nutritional deficiency; (2) it is caused by focal infection.

Why do practically all patients give a history of undernutrition and gradual loss in weight? Is not the onset always slow? Are not most of the cases sporadic? From my personal knowledge and from the literature, I believe the weight of authority would answer the questions in the affirmative. Rodda[4] thinks a tonsillectomy is a specific cure for this disease. Should this method of treatment prove successful, so much the better; but far be it from internists and pediatricians to advise such an operation during the active stages of the disease, especially when it has definitely become an infection. Most of the cases recover without treatment, because with increasing age various kinds of foods are added to the diet. Anorexia usually exists, so that the mother gives one thing after another, hoping that the child will take it willingly, until she finally finds something that he will take. If the child comes under a physician's care and a diet rich in vitamins is prescribed, you will observe a rapid improvement. It is well known that breast-fed babies, whose mothers are apparently in an excellent nutritional condition, develop acrodynia, but upon addition of vitamins A and B to their diets in sufficient quantity, the disease clears up rapidly. Perhaps there is bodily weakness and consequent susceptibility to disease, due to the deficiency or absence of one or more important food elements.

The etiology of acrodynia aroused my curiosity after I read Rodda's article, to which I have already referred. I decided to review the cases in the Children's Hospital of Philadelphia, where I was at that time chief resident. Unfortunately, there were no cases recorded previous to June, 1925. However, I have been able to see three cases with this malady within the space of one year. There were probably unrecognized incidences of the disease at this hospital, as in most institutions. The following are the three patients presented:

Case 1.—N. C., a white boy, aged 2 years and 10 months, had not been well following pneumonia two months previously, in March, 1925. He had been irritable, losing weight and perspiring a great deal. There was no vomiting nor fever. The child complained that his stomach and head ached. He was always fretting. His hands and feet had been peeling for two weeks. Physical examination revealed an undernourished, poorly developed boy who cried and resisted examination. The tonsils were large, red and cryptic. The pharynx was red and the lips were pink. The palms and soles were reddened, thickened and boggy, showing desquamation. He was conscious, fretful, seemed depressed and would not stand. Over the chest and under the thighs were raw areas from which serum exuded. There was a diffuse maculo-papular rash over the back and buttocks. Various diagnoses were made, including scarlet fever.

The patient was treated expectantly until the condition had cleared up entirely except for an infection of the third right finger. Infection had left the nails hypertrophic about their bases. His appetite was good. He returned in April, 1926, having made a complete recovery. The tonsils were ragged and enlarged at this time. Tonsillectomy was performed in May, 1926, with good results.

This patient gave a history of an occasional cold during the previous winter, but there was no return of the acrodynia. He had a brother a year younger, besides many playmates, and all escaped the disease. It is difficult to believe that he was a harborer of a specific infection, since he did not transmit it to anyone.

Case 2.—In Raymond G., a white boy, age 18 months, the chief complaint was that the hands and feet remained cold and blue. The onset of this condition occurred five months previously during dentition, when he was 13 months old.

Following the eruption, the symptoms had become more exaggerated. The hands and feet remained pink and cold. The appetite had been poor and the nourishment very limited, since he refused food. He was extremely irritable. The extremities were edematous at times. Constipation alternated with diarrhea. He had a cold with a running nose and cried constantly.

He was undernourished, but fairly well developed. The back was weak, and he stood for a short time only. Photophobia was marked. The tonsils were red, but not bulging nor enlarged. There was a slight raw rash around the buttocks. The soles and palms were pink with slight desquamation over the toes and fingers. There was a mucopurulent discharge from both nares.

The diagnosis was acrodynia.

The patient was kept in the hospital about six weeks until he began to gain weight. He was placed on a well balanced diet rich in vitamins. He was then sent to a country home, where he continued to improve, and information was received in April, 1926, four months after his admission, that he was well. His tonsils were not removed.

Case 3.—The chief complaint of John P., a white boy, age 2 years and 11 months, was that he had sore leg and was cross.

The boy had begun to limp three days before his admission (April, 1926), though there was no history of trauma. He had had a head cold with a nasal discharge for several weeks. He was somewhat irritable.

He was undernourished and thin. He had a slight photophobia and a mucoid nasal discharge. The fingers and toes were cyanotic, while the palms and soles were beginning to become discolored. There was tenderness over the right buttock, under which was a firm mass. The tonsils were injected but small. The buttock abscess was opened, which proved to be a necrotic hematoma, or a sterile abscess. The case was diagnosed as early acrodynia, with a sterile hematoma of the buttock.

He has been followed in the dispensary, receiving a well-balanced diet. The coryza has disappeared, while the pinkish condition of the extremities has gradually subsided.

The three cases of acrodynia include one which had marked signs from the onset; the second, and especially the third cases, were very insidious. These patients ran a chronic course, and did not terminate abruptly as in the tonsillectomized cases of Rodda. Since the nasal discharge in the mildest of the three cases was mucoid, the nasal discharge of the two more advanced was mucopurulent, while there seems to be a hyperemic inflammation rather than an active infection.

The laboratory study of the throat (tonsils and pharynx) and the nasal secretion showed the ordinary or usual bacterial flora with a preponderance of the *Staphylococcus aureus* and the non-hemolytic streptococcus in the order named. Because of the lowered vitality and resistance of the patient, infection is invited especially in the mucosa of the nasopharynx. If the tonsils are diseased in this malady, it is advantageous to extract them as in any other disease, but this procedure is not advised as a routine measure in dealing with acrodynia. Several cases of acrodynia in the adult have been demonstrated in the past year. These recent cases as well as those found in the history[5] of acrodynia indicate strongly a lack of proper food.

CONCLUSIONS

(1) Acrodynia is primarily a deficiency disease with a superimposed infection.

(2) Three cases of acrodynia have been presented with various degrees of involvement. All recovered without having tonsillectomies, while only one had diseased tonsils.

(3) Infection occurs easily in these patients, usually being found in the nasopharynx and not solely in the tonsils.

(4) The infection has a synergistic action on the symptoms of the disease.

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LEUKOPLAKIA BUCCALIS: A STUDY OF EIGHTY CASES*

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and
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Leukoplakia is probably as old as mankind, however, Schwimmer[1] in 1877 was the first to give it this name. Previously, Sigmund and Bazin had described it under a different terminology. Earlier writers referred to it in various terms or in relation to other conditions. In 1915, Levy[2] made a valuable review of the literature. Many other splendid articles have been written from time to time. Bloodgood[3] in 1921, Hazen and Eichenlaub[4] in 1922, and Howard Fox[5] in 1925 made the most valuable contributions, tending to crystallize opinion with reference to etiology and to treatment. These presentations also clarified the conception of the nature and course of leukoplakia.

Since leukoplakia is easily recognized and its pathological changes are well understood, this phase of the disease requires no comment. Lichen planus and lupus erythematosus are the conditions with which it may be most frequently confused. Patients with either of these diseases having lesions resembling leukoplakia are not included in this series.

This discussion is a brief review of observations on 80 cases of leukoplakia involving the oral mucous membrane. All are taken from the files of our office patients. Since they are private cases, many of the routine laboratory and clinical tests were not made. Many tests were unnecessary. The chief object has been to report those observations that might shed light on the etiology, the course of the disease, and results of treatment. The following factors have been considered: sex, age, duration, syphilis, diabetes, use of tobacco, carious or sharp edged teeth, and dentures.

Sex.—Of the 80 patients, 66 were males and 14 females, a ratio of approximately 5 to 1, which may be partly explained by the more extensive use of tobacco by men, although the ratio of tobacco users between the sexes is probably higher than this. However, the use of tobacco by females is steadily on the increase.

*Read in Section on Dermatology and Syphilology, Southern Medical Association, Louisville, Kentucky, November 11-14, 1930.

Undoubtedly other etiologic factors contribute to this disproportion.

Age.—The average age of all patients was 51.1 years. The average age for females was 54.4 years. The average age for males was 50.4 years. The oldest patient was 79 and the youngest was 25. One patient aged 30 stated the condition had existed for ten years.

AGE BY DECADES

20-29	6
30-39	13
40-49	11
50-59	28
60-69	12
70-79	10

It is evident from this tabulation that leukoplakia rarely ever occurs in childhood and youth. The third decade shows decidedly the lowest incidence. It is noteworthy that the peak is reached in the sixth decade, which is also the average age.

Duration.—The average duration was 34½ months, or almost three years. The longest had existed thirty years and the shortest one week. From these facts it appears: first, that it is usually a disease of slow development; second, that it may be apparent very early, even to the patient. The case of 30 years' duration was a physician who smoked a pipe inveterately. The case of one week's duration was a smoker who also had a positive Wassermann test.

Several cases had existed three to ten years, or longer, without advanced development, while others of fairly short duration showed marked vegetations and other advanced signs. In this respect, this condition is similar to keratosis of the skin in that it is difficult to determine those which will undergo early malignancy.

Syphilis.—In every case a careful history for possible syphilis was elicited. This investigation included inquiry with reference to resistant sores, eruptions, ulcers, alopecia, adenopathy, rheumatic pains, headaches, miscarriages, and so forth. In the great majority of patients no such evidence was obtained. The Wassermann test was advisable in 21 cases. Of these, 6 were positive, all of which gave definite histories of syphilis. Two others presented a history of previous syphilitic infection, and had received antiluetic treatment at the hands of others. Both of these had repeated negative Wassermann tests. Their histories were such as to make this diagnosis doubtful, but nevertheless they were classified as syphilitic. These two cases added to the group of six with the positive Wassermann reaction make a total of eight. This is an incidence of 10 per cent, which is exceptionally low in comparison with the reports of earlier writers. For almost fifty years, since the time of Schwimmer, most authorities have regarded syphilis as the cause of leukoplakia in from 50 to 100 per cent of cases. In 1921, Bloodgood reported an incidence of 21 per cent. In 1922, Hazen and Eichenlaub liberally estimated the incidence at 30 per cent and stated that it was their belief that "Syphilis represents an accidental, rather than a causative factor in the disease." As late as 1925, Howard Fox made the following statement:

"In 65 per cent of my cases a previous syphilitic infection was judged to have occurred from the history, Wassermann reaction, or presence of tertiary manifestations." To quote further from the same writer, he states: "While my percentage is not as high as that of some other observers, it is too high to ignore the relationship of the two diseases."

Fox's figures are based on 40 cases. His incidence of 65 per cent and ours of 10 per cent make a disparity so wide that an explanation is necessary. Certainly no one could doubt the accuracy of Fox's observation. The incidence of 10 per cent syphilis in this group represents a liberal allowance for questionable cases. What, then, is the explanation? This group was selected from private cases and most of them were from the better class of people. Possibly Fox's cases were from public clinics. This might account for the wide difference. It was noted that all of the cases with syphilis used tobacco excessively. Two had bad teeth and one was edentulous. It would seem from these facts that syphilis plays only a minor role in the etiology. It is apparently a predisposing factor, but not essential to the disease.

TOBACCO

Of the 80 cases, 69 (86 per cent) used tobacco in excess in some form.

Of the 66 males, 60 (91 per cent) used tobacco.

Of the 14 females, 9 (64 per cent) used tobacco.

Of the males, 29 were pipe smokers, 20 were cigar smokers, 9 were cigarette smokers, and 19 were chewers.

All 9 of the females used snuff.

Interesting observations have been made in regard to the use of tobacco. For instance, in three or four pipe smokers, the thickest lesions tended to form in paths where the smoke stream was directed to the side of the tongue or cheek from the stem of the pipe where it was habitually held. This was very definite in one edentulous diabetic. In chewers and snuff dippers, verrucous or thick patches frequently developed at the place where the quid of tobacco

or the mass of snuff was held, thus directing the irritant to one area of the mucous membrane at the site of the accustomed parking space. This seems to emphasize the important role played by tobacco from the standpoint of etiology. In fact, it appears to be the most important single factor.

TEETH

Carious teeth, 14.
Sharp edged fillings, 5.
Extensive pyorrhea, 4.
Teeth without pathology, 34.
Edentulous, 16.
Ill fitting plates, 3.

In a few cases the most intense leukoplakia was found adjacent to sharp, irregular teeth. In three cases, the leukoplakia was found at the site of impingement from ill fitting dentures. The presence of plates seems to intensify the irritant effect of tobacco and snuff. This may be due to tobacco getting under the denture or to neglect in cleansing. Bad teeth and dentures are important factors as causative agents, especially in tobacco users.

Diabetes.—Of this group, three were definitely diabetics. All of them were men who used tobacco and gave negative Wassermann reactions. All had rapidly forming vegetative lesions.

Severity.—In the following classification, the smooth, superficial lesions, regardless of size, were considered mild. The verrucous and vegetative lesions were termed leukokeratoses.

Mild cases, 49 (61.5 per cent).
Leukokeratoses, 26 (32.5 per cent).
Carcinomata, 5 (6.25 per cent).

It is interesting to note that 5 of the 80 cases had malignancy. Three of them died of carcinoma from the primary mouth lesion. Two malignant cases were seen very early and have remained well for nearly two years. Two cases with definite early carcinoma eventually died.

The fifth case, while under our observation, developed a small epithelioma the size of a pea on the side of the tongue. This lesion was treated with radium and removed by electrocoagulation. It was arrested for nearly two years, recurred, was again checked for a year, then reappeared and metastasized to the cervical lymph nodes, resulting fatally. He was under observation for over five years. This patient was a rather bad diabetic. He had suffered with glycosuria for the previous ten years.

OUTCOME

Cured 22
Improved 42
Recurrent 9
Died 3
Arrested carcinoma 2
No data 3

All five carcinoma cases had negative Wassermann reactions and gave negative histories for syphilis.

These observations tend to show that leukoplakia is very resistant to treatment. If the cause is removed, the case either improves or becomes stationary. Cases with circumscribed verrucous lesions usually respond better than those with widespread superficial ones. Cases with lip involvement do well as a rule.

Treatment.—The treatment was varied to suit the case. In very mild cases an effort was made to remove the irritating factor and local applications were not made. In some of the mild cases with distinct slightly raised plaques, full strength trichloracetic acid was carefully applied. Usually such lesions responded promptly, but recurred in several instances. Leukokeratoses were formerly removed entirely by electric cautery. More recently, electrocoagulation has been employed part of the time. It is especially effective in infiltrated lesions. The results have been as good or better with this method than with the cautery. Recurrences may take place after the use of either method. About ten years ago the radium plaque was used in a few cases, employing both single large doses and repeated light applications. The results did not warrant a continuation of this procedure. This seems rather strange, since the best results in the cases with lip lesions were obtained with x-ray therapy. This is especially true where the vermillion border is involved. Three to five skin units of therapy are usually sufficient. In all the carcinoma cases an application of radium was followed by electrocoagulation. The lesions were coagulated immediately after irradiation. The coagulated epitheliomatous mass was removed with the curet and the base of the lesion was recoagulated. Best results have been obtained in thick circumscribed lesions in which either the cautery or electrocoagulation was used.

In cases with syphilis active treatment was instituted. In some instances the lesions were also removed.

The following tabulation is submitted for a review of the method of procedure in handling these cases:

x-ray therapy, 22 cases.
Radium therapy, 9 cases.
Removal by electrocoagulation, 7 cases.
Removal by cautery, 22 cases.

Summary.—Leukoplakia rarely occurs in childhood and youth. Tobacco is the most prevalent etiologic factor. While syphilis cannot be ignored, it seems to play a minor role as a

causative agent. It may be the sole cause in a few cases. Not infrequently it seems to produce a lowered resistance for other irritating agencies. Teeth and dentures are undoubtedly exciting causes in a small per cent of cases. Leukoplakia is resistant to treatment. No established rule can be followed. Every case is a law unto itself. Mild lesions covering large surfaces should not receive strong applications. As in other diseases, leukoplakia seems to progress more rapidly in patients with diabetes.

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DISCUSSION (*Abstract*)

Dr. F. J. Eichenlaub, Washington, D. C.—Several years ago I read a paper on the subject, in which rather careful general examinations were made on a group of patients at the U. S. Veterans' Diagnostic Center, where routine tests were performed and complete physical examinations were made. In our first paper on this subject Dr. Hazen and I concluded on the basis of the cases studied that syphilis was probably only an incidental factor. In this last group of cases, however, I found that in the hospital group as a whole the incidence of syphilis was 5 per cent, and in the leukoplakia group the incidence of syphilis was about 40 per cent. So that I have been compelled to change my view as time goes on about the relation of syphilis to leukoplakia.

I believe there is no question that a syphilitic background is a very common condition in the development of leukoplakia. Local irritation may be tobacco or bad teeth or some other form of irritation, but it appears to be essential that there should be some constitutional background, such as infection, syphilis or some other condition to make the disease develop locally.

Dr. H. H. Hazen, Washington, D. C.—I, too, have been caused to change my mind about certain of these cases of leukoplakia. It seems to me that after all the really essential thing is to define exactly what we mean by leukoplakia. Apparently there are two different groups. There is one group in which the disease starts primarily upon the dorsal surface of the tongue, and later becomes thick. In these cases I think we almost invariably find there is a syphilitic factor plus tobacco. On the other hand, there is a group of cases in which the symptoms are of very mild leukoplakia, if you care to call it that, starting on the mucous membrane or the edges of the tongue, or occasionally on the lips, and these are usually induced by bad teeth. As a matter of fact, however, these very mild cases, unless one watches them most carefully, will eventuate into a true leukoplakia, sometimes with fatal termination. I think the discrepancy in the earlier reports of Howard Fox and of Eichenlaub and myself were due to the fact that we were considering largely different types of leukoplakia.

Dr. Walter J. Highman, New York, N. Y.—I would like to agree with Dr. Hazen that leukoplakia can be defined, but it is clinically impossible with unaided eyes. What is seen on the tongue is what we call leukoplakia. What its nature is in an individual case is always *ex post facto* knowledge. This has no value when you are confronted with a given patient.

Now, what follows from Dr. King's figures is, in the first place, that syphilis plays no prominent role in the etiology of the condition, and that that condition plays no prominent role in the etiology of the malignancy. In other words, divested of the scare-head factors in the situation, we have here a chronic inflammatory disease of the tongue, a glossitis that takes the form of thickening of the superficial tissues of the tongue, including the mucous membrane, of course. It further follows that a local irritant of a chemical nature, plus other irritants, plus what it is that makes one man different from another any way, are the factors that play the prominent role in this condition. The outstanding feature of Dr. King's presentation is the effect of tobacco. We know that some of the components of tobacco cause skin irritation. We also know that a slight prolonged skin irritation causes chronic irritation. To me, theoretically for about fifteen years the analogy between the leukoplakia of the buccal orifice and cutaneous muscle lichenification has seemed striking. What the controlling factor may be I do not know. There is no way of telling without further etiological study, but certainly I think Dr. King has made it clear that the majority of cases of leukoplakia represent a harmless condition, both as to origin and as to their eventualization, unless we are going to join the newer society that is going to come into existence some day for the prohibition of tobacco.

Dr. C. F. Lehmann, San Antonio, Tex.—It occurs to me that further histological study should be made on this condition. We know local irritants are more or less constant. I wonder if we have not arterial changes, giving a decreased size to the lumen of the terminal vessels, and consequent decreased nutrition as the basis for the local irritants. This is comparable, for instance, to the hyperkeratosis around a trophic ulcer. Syphilis and senility produce diminution in the lumen of blood vessels. I do not believe that radium is the thing to use. Following its use we have tissue that is atrophic and we accentuate the endarteritis which already exists. As leukoplakia disposes to malignancy, certainly the tissue changes which follow irradiation dispose all the more. I believe that coagulation or cautery is the ideal method of treating it.

Dr. Harry M. Robinson, Baltimore, Md.—Our department of syphilis is entirely separate from our department of skin diseases. And treating only syphilis in the syphilis department, it is comparatively easy to make a thorough survey of all our patients. We examine each patient fully, including eyes, the teeth, mouth and tonsils, as well as skin and chest. In the several years that I have worked in the department of syphilis there have been comparatively few cases of leukoplakia in the syphilitics as compared with leukoplakia found in non-syphilitics in the skin department. While there is no definite comparison, it is my impression that we see as many in the one group as in the other. The cases of leukoplakia that I have seen have been, to my mind, in many instances cases of hypersensitization with the causative factor often determinable. In one case that comes to my mind, we proved it to be nuts; in another coffee, and in still another tobacco; but in all a condition of hypersensitization with a hyperkeratosis of the mucous membrane.

SOME RECENT OBSERVATIONS IN PHLYCTENULAR DISEASES*

By LUCIAN W. ALEXANDER, M.D.,
New Orleans, La.

The disease known as conjunctivitis eczematosa, herpes conjunctivae, phlyctenulosis, scrofulosa, conjunctivitis lymphatica, scrofulous ophthalmia and pustular conjunctivitis, for the purpose of this report shall be hereafter referred to as phlyctenulosis, being characterized by a circumscribed inflammation of the conjunctiva, accompanied by the formation of one or more small reddened projections called phlyctenulae. These may soften at their apices, forming small ulcers. Phlyctenules are found on the ocular conjunctiva (a few cases are reported on the bulbar conjunctiva in tropical countries), and on the cornea. The favorite location is the limbus.

The etiology is as varied as the nomenclature. Among the causes suggested are: tuberculosis, intestinal intoxication, various bacteria, diseases of the mucous membranes, carbohydrate diet, sinusitis, eczema, exanthemata and pediculosis capitis.

The cases studied during the period of two years were confined to those affecting the cornea and conjunctiva. Those in the cornea were of the superficial type, being uncomplicated. Seventeen cases were studied. The comparative rarity of this disease is to be compared especially with the reports of other observers, who state that the disease is most common in children and adolescents. Dr. H. Dickson Bruns in 1912 reported 451 cases, 172 of which were examined by Dr. R. C. Lynch, who found rhinitis, diseased tonsils, suppurative otitis, and so forth, in 105 cases, or 61 per cent. A number of these cases were treated only by removing the diseased tissue in the nasopharynx. The ophthalmia disappeared. At that time Dr. Bruns reached this conclusion:

"It seems to me, then, more logical in the present state of our knowledge to regard phlyctenular ophthalmia not as the effect of a specific toxin (tuberculous) nor as an ocular eczema, but rather as a neuropathic phenomenon brought about by an autointoxication originating in the great majority of cases in the derangement of the gastrointestinal functions; not all persons being equally liable to the morbid processes, but much more particularly those in whom we recognize clinically the scrofulous, lymphatic, or exudative diathesis. Such persons are especially liable to tuberculosis and other infectious diseases, which in turn depress the metabolic and catabolic processes, the functions of digestion, assimilation, secretion and excretion, and thus intensify and perpetuate the state of autointoxication."

Continuing his earlier work, Dr. Bruns requested his staff to transfer all cases of phlyctenulosis to my service for study, suggesting that each case be considered a single entity, using no drugs either by ingestion or instillation, except the parenteral injection of a non-specific foreign protein. Whole cow's milk boiled for eight minutes and strained through two thicknesses of sterile gauze was the foreign protein used in these studies. The raw milk was not placed in an incubator nor on a warm radiator before boiling, as reported by some observers. No pre-hospital treatment was given in any case. On admission to the hospital the temperature, pulse and respiration were recorded and a blood count was made. The foreign protein was freshly prepared and injected into the gluteus muscle. The amount injected varied from 3 to 10 c. c., depending on the weight of the patient, using 1 c. c. per 15 pounds of body weight.

During the past ten years many theories have been advanced to prove just what action these foreign proteins had on the body. The most outstanding are: first, there is certainly a well marked leucocytosis, which in itself is capable of adding to the body defenses; second, the body cells are stimulated to produce anti-substances; third, there is an increase in the permeability of capillaries; fourth, there is an increase in body temperature, reducing the virulence of the infecting organism.

In our choice of whole milk we found a foreign protein that was fairly constant in composition, is cheap, and easy to prepare. Other foreign proteins may be used, as for example, typhoid vaccine, horse serum, and so on.

Generally speaking, we found that the best results were obtained when enough of the foreign protein was injected to produce a temperature of 102 or 103° in six to eight hours after the injection. At the height of the temperature chart a second blood picture was made which showed principally an increase in leucocytosis. Within 12 hours following the injection, the patient is relieved of the pain, irritation and photophobia. In the eye itself there is a decrease in the inflammatory process and beginning of repair. If the inflammatory process has not entirely subsided in 48 hours another injection is made. Some of our cases required only one injection and no case required more than three.

*Read in Section on Ophthalmology and Otolaryngology, Southern Medical Association, Twenty-Fourth Annual Meeting, Louisville, Kentucky, November 11-14, 1930.

These patients were not discharged from the clinic after the treatments, but were requested to report back for observation. To date we have seen no recurrences in any of our cases.

In concluding we have observed that, first, by the use of a non-specific foreign protein the duration of the disease was shortened; second, the cause must be a result of lowered resistance; third, the disease is decreasing, both in severity and numbers, at least in New Orleans. Undoubtedly improved hygienic conditions, better housing, especially in the public schools, an excellent water supply (bacteria-free), a well balanced market (seafood, animal food, fresh fruit and vegetables being available at all times, in winter as well as summer) with a bland climate must play a leading role among the factors responsible for the decrease of this disease.

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DISCUSSION (*Abstract*)

Dr. R. M. Armstrong, Lexington, Ky.—There is no general agreement as to the etiology of phlyctenular conjunctivitis and keratitis; no decided line of demarcation can be traced.

Homer regarded phlyctenules as merely ocular manifestations of eczema and these studies were confirmed by Sidney Stephenson. Phlyctenular diseases of the eye go hand in hand with the symptoms of tuberculosis, such as swelling of the joints, bone lesions, abscesses of the lymph nodes below the jaw, otorrhea, dactylitis and lupus. This disease usually follows measles, scarlatina and such conditions. Rhinitis is most always present and adenoid vegetation is common. Intestinal parasites are frequently present and hereditary syphilis may be a factor.

Climate and racial conditions seem to have an influence and probably improper diet may play a great part in phlyctenular conjunctivitis.

Recognizing phlyctenular conjunctivitis as largely a local expression of a systemic disturbance, it is the duty of the ophthalmologist to find and remove the cause, while at the same time local treatment is to be applied. Errors of diet and deficiencies must be corrected, sugar and starches restricted and certain vitamins supplied. Of course we recognize fresh air as being essential, the skin must be kept clean, and the bowels open.

In treating our cases for the past two years we have discarded the whole milk injections in the gluteal region, using instead paratyphoid vaccine. This has many advantages over whole milk.

Dr. G. W. Blackshear, Opelika, Ala.—As Dr. Alexander mentioned, there has never been any general agreement as to the etiology of phlyctenular conjunctivitis and keratitis. Every condition has been advanced as a possible etiological factor, from sinusitis and tonsillitis to intestinal parasites.

With such a variance of opinion we can safely assume that this condition is not the result of any one specific disturbance. Hence, up to now, there has never been one specific treatment. I have always felt, and I think that here is a general agreement, that phlyctenular disease is merely the local expression of some systemic disturbance. Our time and attention have always been given to trying to ascertain the nature of, and in the correction of, this systemic derangement; in trying to build up the general resistance and the lowered vitality of the patient by the administration of cod-liver oil and other tonics as indicated. This, with our local treatment, atropine, when indicated, powdered calomel, or yellow oxide of mercury, has been our main reliance.

But, from Dr. Alexander's observations, a new and efficient weapon has been added to our armamentarium of therapeutic measures.

A measure that will enable us to relieve the pain, irritation and photophobia of phlyctenular diseases in twelve hours and cause a beginning repair process within twelve to twenty-four hours is one that we should receive with hymns of praise and thanksgiving.

Dr. Louis Daily, Houston, Tex.—I had the opportunity in Vienna on the Neumann Clinic, in 1922, to use milk injections in acute otitis media under the supervision of Prof. Linder. The longest time that we boiled the milk was four minutes. The less we boiled, the better the result. We did not dare to inject milk that was boiled less than three minutes. We began to count the minutes from the time the milk began to rise. The dirtier the milk, the greater the reaction; and the higher the reaction temperature, the better the result.

Dr. G. M. Maxwell, Roanoke, Va.—About a year ago I treated an eight-year-old girl with severe phlyctenulosis by the administration of milk hypodermically. The treatment was quite successful. Since that time I have been using no other treatment except, of course, the examination of sinuses and nose and throat for evidence of infection, and without exception I have gotten better results than ever before. The treatment certainly is empirical. We get good results without knowing exactly how, but we are helped wonderfully in the eradication of this disease.

Dr. W. R. Buffington, New Orleans, La.—Coming from the same city as Dr. Alexander, I must disagree with him as to the rarity of this condition. Dr. Alexander has worked in a clinic that would probably be called a "silk stocking" clinic. I work in a clinic where we see many negroes, the Charity Hospital, a State institution, and there the incidence of phlyctenular disease is high.

Milk injections relieve only the symptoms present today; they do not cure the disease that is coming tomorrow or next day. The basic cause should be treated. I say that it is a nutritional disturbance, and as in other diseases, you must remove every focus of infection.

Dr. J. A. Stucky, Lexington, Ky.—I believe that phlyctenular conditions are an end result, a local manifestation of a systemic disturbance, and when we can control the feeding of our patients we can prevent this trouble. A soothing local treatment with the ad-

ministration of malt, cod-liver oil and syrup of iodide of iron, restricting the use of sweets and starchy foods, feeding principally green vegetables, fruits, milk and other dairy products, speedily ends the trouble.

Dr. Alexander (*closing*).—Dr. Buffington's clinic is a little different from mine. I started my studies in New Orleans under the instruction of Dr. Buffington, and I consider that a large percentage of my knowledge of the eye is due to his very efficient teaching. When I first went into eye, ear, nose and throat Dr. Buffington was on the teaching staff, and each day we used to see 2 or 3 new cases of phlyctenular disease. Whether they deserted us and followed Dr. Buffington over to the Charity Hospital I do not know, but we do not see them in our clinic as we used to.

GINGIVITIS VIII. GINGIVITIS AN ENTITY, INCLUDING ALL FORMS FROM ACUTE VINCENT'S TO CHRONIC PYORRHEA: DESCRIPTION, BACTERIOLOGY AND PATHOLOGY*

By ROBERT A. KEILTY, M.D.,
Washington, D. C.

This is the eighth in a series of papers[1] on gingivitis[2] and its purpose is to review the author's conceptions and call attention to the importance of study of the condition. Over 90 per cent of the adult population of the United States and certain other parts of the world are suffering from some form and degree of pathological change in the soft structures of the gingivae, the periodontal membranes and the bone about the teeth. The chronic type of these changes, termed pyorrhea by the dentist, has been treated by every possible method and drug and yet the process has not been stopped and its incidence is about the same per 1,000 of population as it was twenty-five years ago. In addition, during the past ten years there has developed and there now is an epidemic of acute ulcerative gingival reaction. This is mostly in young adults and will certainly lead to a further increase in the chronic incidence in the next twenty years unless something is done.

During the past ten years I have carried on more or less systematically a study of this area and now have records of over 7,000 cases. The last 2,000 cases are quite complete and have occurred in the private practices of a number of dentists in Washington to whom I am indebted. This allows follow-ups and check records from time to time. In this way the ultimate results of a method of treatment will be consistently checked and the conceptions subjected to definite conclusions. The conclusions may be subject to change as the work progresses.

The term pyorrhea should be discarded. The terms Vincent's disease and trench mouth, while descriptive, are not specific. The acute and chronic inflammatory diseases are closely allied in their bacteriological make-up and their pathology is that of different stages of inflammation. The term gingivitis has been offered to cover all this inflammatory change. It must be qualified by its degrees, acute or chronic, and by its type, exudative, ulcerative or suppurative. It is understood that the chronic phases of gingivitis include changes in the periodontal structures of the teeth, the periosteum and the bone. The term gingivitis so qualified is specific enough and if understood as inclusive of the hard structures about the teeth, easily supplants the more cumbersome periodontitis and the more popular periodontoclasia. It will be clear, in an analysis of the word periodontoclasia with its offspring periclasia, that it is not correct because these inflammatory changes are certainly not all destructive, as the Greek, "*klastos*, I break," would indicate.

There are many fallacies which have crept into the literature and I have called attention to some of these. For example, every case of so-called trench mouth, which is an acute ulcerative gingivitis with or without stomatitis, is not necessarily of spirilliform origin, but may be due to the streptococcus. It is not correct to treat these cases with arsphenamine intravenously. In the first place, if spirilliform organisms are present, the effect of the intravenous use of arsphenamine is almost negligible, and if the disease is of streptococcic origin, arsphenamine is of no value. The same may be said of perborate of sodium and a number of other drugs in common usage.

I have offered the bacterial flora and the protozoal infestations as the most important etiological factors in these gingival changes.[3] I have also given due allowance to the influence of other factors, well known to dentists, but consider them of secondary importance. These factors are traumatic occlusion, poor fillings, ill-fitting crowns and dentures, calculi, somatic conditions, calcium phosphorus imbalance, irritations of smoking and poor dental hygiene.

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*Read in Section on Pathology, Southern Medical Association, Twenty-Fourth Annual Meeting, Louisville, Kentucky, November 11-14, 1930.

*From the Mary A. Keilty Research Memorial.

In a previous communication[4] the pathology as recognized clinically has been described under three headings: acute, subacute and chronic gingivitis. It is necessary first to establish definitely what is considered a normal. This is difficult to do, but work is now being carried on by the histological anatomists to this end. I have given the incidence of gingivitis for all adult decades as 92 per cent. This is conservative and I think the dentists agree with me that 3 per cent is a large allowance for perfectly normal mouths from their standpoint. In other words, a true normal gingiva is rarely seen in adult mouths. The normal gums are not red but pallid and pink. They are firmly attached to the teeth above the cemento-enamel junction, there are no areas of bogginess nor tenderness and they cannot be made to bleed except by actual cutting. The normal gingiva or arrested gingivitis will not bleed on vigorous brushing. The sulci are shallow anatomical trenches and there are no pockets. There is no exudate and the material from the sulci examined microscopically shows desquamated epithelium, a few white blood cells and a very scanty bacterial flora. There are absolutely no spirilliform types, no protozoa and the culture shows a predominant residual staphylococcus or streptococcus.

In acute gingivitis, the gums show all degrees of acute inflammatory reaction from marginal redness, bogginess with slight exudate and bleeding, to advanced swelling, ulceration, suppuration and false membrane. The sulci become deep trenches and even pockets. The exudate becomes heavily laden with blood and pus cells and as a rule teems with the predominant types of bacteria. The protozoa do not play a part in the acute exudate except as they occur in a preceding chronic condition. The spirilliform organisms, if present, are found only on smear, and then in millions. An equally bad mouth may be seen with complete absence of spirilliform organisms when the predominant organism obtained on culture is a streptococcus. Rarely other organisms, such as *B. diphtheriae*, may predominate in these acute reactions.

In subacute gingivitis, which has no true pathological counterpart, the condition is a mild chronic type or acute flare-up due to re-infection on an arrested chronic type. These cases might all be placed under the chronic heading, but clinically are better grouped as subacute.

In chronic gingivitis the process has been insidiously progressing or has been initiated by an acute reaction which was never controlled. The gingivae show all the degrees of exudation and suppuration with deep gingival pockets leading to periodontal involvement and bony absorption. These exudates contain a wide variety of bacteria and protozoa. Certain forms are seen only on smear and the culture usually shows a predominant with four or five other scattered types. The spirilliform group, the fusiformis, the vibrios, the leptothrix are found on smear with the protozoal endameba and trichomonas. I have previously described these organisms and hope to complete the details in this series of papers.

I ask for cooperation on the part of the bacteriologists for more study of the bacteria of the gingival exudates. This will include more than the mere reporting of a stained slide for Vincent's organisms or a culture for *Streptococcus hemolyticus* or *viridans*. Such reports are little better than useless unless an understanding of the conditions governing their occurrence is evaluated. The major trouble lies in the fact that the dentists know nothing about the bacteriology and certainly most bacteriologists and even most medical men pass over the teeth as though they did not exist. The problem of periapical dental infections has been established, but not entirely solved. Why is there not more interest in the gingival sulcus? The gingival sulcus is something a great deal more than the site of filth and bacteria normal to it. It deserves its share of consideration. We have considered this area a mere mouth contamination unworthy of mention long enough. The relation of the gingival sulcus to many of the periapical infections is apparent and indeed the gingival route of infection is often much more important than the root canal in a given instance.

These exudates are first of all studied by fresh smears in saline suspension.[5] The material is taken from individual sulci and pockets using a 22 gauge chrome nickel loop. The slide is examined under the 4 mm. objective first and the detail under the 1/12 oil immersion. It can further be studied by dark field illumination. Here all manners of cells, foodstuffs, bacteria and protozoa will be found. After some experience these can be picked out and identified, especially the group which does not lend itself to easy culture. Stained smears can be made separately or the original saline suspension can be smeared and dried after the organisms have been examined. The stained smear does not give the information that the fresh one will. The Gram method will differentiate

certain types, especially the cocci and bacilli. The fresh smear is much to be preferred.

In studying cultures, blood agar plates, agar slant anaerobes, plain and sugar broths, hormone medium, brain broth tubes and Sabouraud's sugar tubes will pick out individual groups. The yeasts and fungi alone offer a very prolific field for original work, as little or nothing is known as to their actual relationship to these various changes, and yet they are frequent organisms in these conditions.

In order to prove the relationship and pathogenicity of the bacteria in this work it has been necessary to carry on chemotherapeutic studies.[6] This has turned out to be of value clinically to the dentists and I have offered, by a set-up of blood agar tubes containing varying dilutions of antiseptic substances, a method for rapidly picking out *in vitro* an antiseptic substance which might work as a specific *in vivo*. In practice this method has had considerable success. From this work a new phenomenon for bacteria, elective bacteriostasis, has been described.[7]

Gingivitis based on these studies assumes some importance along several lines, more especially concerned with the dentist and the clinician. The most important observation is that of the prophylactic value of preoperative treatments before every extraction of a tooth. By this means a mouth is completely studied before anything is done, the bacteria are identified and the necessary type of treatment is outlined. The plan of procedure is mapped out from this, the dentist's concept of the mouth and x-rays. Treatment is given, and following a bacteriological check all surgery, whether it be one tooth or all teeth, is completed at one time with an immediate replacement appliance previously prepared. This does away with all reactions after dental extractions, and guards against all postoperative infections with the occasional death. It gives the patient a reasonable chance of freedom from suffering and functionally and esthetically restores the mouth by an immediate replacement. In a series of several hundred cases handled by this means we have not had a single deviation from the results anticipated and many of the cases are quite remarkable.

Another phase in which such a concept of gingivitis plays a minor but an economical and satisfying role is the relation of firm fixation of partly edentulous mouths after treatment, the arrest of advancing changes and the ensuing stability and comfort of dentures. This is most gratifying from the patient's point of view.

In a recent review[2] of 100 selected dental cases from a group of 2,000 the percentage of arrested gingival cases based upon these concepts of bacteriology and pathology with completed appropriate dental treatment was 95. This arrest means that the inflammatory disease is under control and in the series they have remained so from one month to one year and a half.

In this same group 57 per cent showed evidence of focal infection in which the dental area was definitely involved. As a result of the dental clean-up 44 per cent were cured (by this I mean the focal symptoms entirely disappeared) and 42 per cent improved. This gives a total of 86 per cent of definite improvements. This is not only a creditable result but is proof, I think, that the gingival area plays its part in focal infection.

In conclusion, it has been impossible to go into any detail in the time allotted. The paper calls attention to the importance of and offers a systematic study for gingival infections.

The study thus far has systematically classified all inflammation about the teeth not otherwise specific in character as acute, subacute and chronic gingivitis with appropriate sub-types. It has eliminated such terms as pyorrhea, Vincent's disease and periodontoclasia.

It gives to the bacteria and protozoa present a predominant role in the etiology of gingivitis and to all other factors an important but a secondary role.

The bacteria and protozoa involved have been enumerated and given their appropriate positions.

A method for specific chemotherapy *in vitro* has been offered which has been applied clinically and found of direct value and assistance in clearing up individual cases. As a part of this the work has noted a new phenomenon which bacteria exhibit toward antiseptic substances and this has been described as elective bacteriostasis.

The study has established the fact that preoperative gingival treatments given according to these concepts has eliminated postoperative infection with cellulitis, osteomyelitis and death. In several hundred cases there has not been a single incidence of such an accident.

It has established the fact that all dental surgery should be done at one time, that is, after the patient is properly prepared, and not on several occasions as is now the practice.

It has allowed where necessary the preparation beforehand of dentures for immediate replacement, which is a definite source of satisfaction to the patient functionally and esthetically.

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DISCUSSION (*Abstract*)

Dr. M. Pinson Neal, Columbia, Mo.—We can all recall the phenomenal work and the publication of the findings of Bass and Johns a few years ago in relation to the endameba found in diseases of the mouth. Since that time, to my knowledge, nothing of very much importance has been done on the lesions in the mouth until Dr. Keilty and his group took up the work. The work of Drs. Bass and Johns called particular attention to the mouth as an area of common infection, and even though we lay aside the endameba, they opened up a wide field for study. Some of the lesions are primary and in the mouth, others entirely secondary, as in the lungs, where we find aspiration pneumonia and pulmonary gangrene, some in the kidney, as pyelitis, and acute nephritis (suppurative as well as non-suppurative), others in the heart, as valvular lesions and myocarditis, and still others in various parts of the body, as in osteomyelitis. These secondary lesions are attributed to the primary focus of infection in the mouth, its processes, and its closely related spaces and tissues. I do not think I am wrong in stating that more diseases have been attributed to mouth infections than to any other type, yet only too often with very little background or facts to support such claims.

Dr. Keilty has mentioned the type of gingivitis seen as a part of the picture in agranulocytic angina. In this disease it is to be emphasized that we have a more or less characteristic blood picture, and general manifestations in the patient which are diagnostic of the disease, and are absent in other forms of gingivitis. Another group of diseases that must be differentiated from simple gingivitis is the acute leukemias. Again, we have the characteristic and diagnostic blood picture and other clinical manifestations that are absent in the purely simple and local gingivitis.

I think Dr. Keilty's work, like that of Bass and Johns, will fall short of what he visualizes for it, and of what it might accomplish unless and until dentists are prodded with a very red-hot poker frequently and often.

Dr. Jack C. Norris, Atlanta, Ga.—I wish to ask Dr. Keilty whether he has made any dark field examinations of the flora of these mouths?

In a case of mine, a young woman had an ulcerated gum with symptoms of Vincent's. We reported *Treponema pallidum*. Later she presented a syphilitic syndrome, which responded to arsphenamine. I had quite an argument as to the possibility of differentiating by dark field examination the spirochete of syphilis from the ordinary spirochete of Vincent. I believe it can be done.

Dr. J. A. McIntosh, Memphis, Tenn.—I am connected with a general hospital which has instituted a routine dark field examination of surgically removed tonsils. The examination consists of cutting the tonsils from pole to pole, scraping the incised surface from side to side, putting the juice on a slide, and mounting it for dark field examination. We found innumerable spirochetes present in many and with practice were able to differentiate them. We rarely observed them in tonsils from children, but often from adults. If the tonsils are not considered when the gingivae are cleared up, they may reinfect the gingivae.

Dr. Foster M. Johns, New Orleans, La.—Dr. Bass and I decided several years ago that we were entirely too early with our endameba work, so we did not push it at all; we had not sufficient proof to convince the majority of physicians that these protozoa were almost obligate contributing factors.

The study of alveolar-dental pyorrhea is different from the study of gingivitis. We have divided gingivitis into several classes: acute, chronic and alveolar-dental pyorrhea. You will notice from several of Dr. Klugh's plates that all of the disease process has localized on one or two or three teeth, and the rest are clear. That was one of the things that started our studies on alveolar-dental pyorrhea. Here was a disease with sufficient horsepower to dig in for itself.

I early started sectioning. After wasting several months on ordinary autopsy material, we turned our attention to the coroner's office. We have had three cases in which we were able to get a piece of jawbone only several hours old, and from this material to make sections for study.

Before the American Medical Association in 1915 I presented some 40 or 50 microscopes with serial sections, with lesions showing undoubted amebae at the bottom of these lesions. We have proved their presence within the tissues.

If it is a question how vicious these amebae are, I should like to state that the only claim we made was that amebae caused the pyorrhea in an incidental manner. If you will turn back to some of the drawings in the book entitled "Pyorrhea Alveolaris," by Dr. Bass and myself, you will find our idea expressed that the amebae were factors in the interference with the healing of these lesions. They simply plant and replant the bacteria below the natural borders of the granulation tissue which nature forms in the bases of these ulcerative lesions.

Dr. Roy R. Kracke, Emory University, Ga.—I was particularly interested in Dr. Keilty's remarks about agranulocytosis. I should like to ask Dr. Keilty if he has any data regarding the blood counts of cases of acute gingivitis. We have been particularly interested in the etiology of agranulocytosis, and Dr. Roberts, of Atlanta, and I recently published a paper upon its etiology. We assume that it is primary in the bone marrow and the angina that follows is a secondary infection. In reviewing the literature I found that over half of the patients (the total at this time being over 300) gave a history of going to the dentist, so it occurred to me that a mouth lesion may be responsible for the disease. But the other half have not given any history of a mouth lesion or dental work. So we are interested in why the bone marrow ceases its work in that particular condition. It is also interesting to note that (so far as I know) there has been no case reported of this disease in a negro. Most of the cases reported are in women, as a rule living under rather good economic conditions: in people who, as a rule, take care of their teeth and have dental work done.

Dr. Keilty (closing).—It is squarely up to the dentist to prevent these postoperative infections. There seems to be no reason why a patient should have a cellulitis or osteitis following the removal of a tooth.

Considerable experience is required to distinguish the different spirochetae on dark field examination. I had a case not long ago of suspected chancre which proved to be Borrelia by the dark field. This cleared up very promptly under local treatment and the Wassermann remained negative.

We are now interested in the isolation of fungi from the gingivae and are getting a higher percentage of yeast than formally. Just what this relationship is we are not ready to state, but believe these forms play some part in gingivitis.

Dr. Johns may be interested in Lynch's article on finding endameba on dentures. This does not mean a thing, since the endameba present on the dentures may have had their origin in tonsillar pockets. The endameba, of course, will not live on clean dental plates.

I have placed pyorrhea under the heading of chronic suppurative gingivitis. The accompanying somatic disturbances are often sequelae of gingivitis rather than primary causes. The Entamebae and Borrelia are responsible for stirring up and agitating *in situ*, whereas the streptococcus gets down into the tissue and is the important factor in distant manifestations of the focal infection.

I think we have had about eight cases of agranulocytosis in connection with stomatitis. I believe in this group of cases the primary infection is in the mouth. They recover promptly when treatment is directed at the mouth. If the etiology were in the bone marrow they would not recover under this principle of treatment. The treatment consists of hospitalization and a barrage of specific chemotherapeusis. If they get well under treatment directed at the mouth, and the agranulocytic condition clears up, it must be assumed that the primary etiology is in the mouth.

THE SURGERY OF PULMONARY TUBERCULOSIS*

By ALBERT G. RUTHERFORD, M.D., F.A.C.S.,† Welch, West Va.

During a discussion of the possibilities of surgical treatment of pulmonary tuberculosis held by the New York Surgical Society a few weeks ago, it was stated by one of the speakers that 33 per cent of the cases he had been instrumental in treating had returned to full activity, being able to lead normal lives for observation periods as long as ten years. When we consider that this is a better operative result than is obtained in many conditions requiring major surgery, carcinoma, for example, we should not hesitate to make use of surgical measures in pulmonary tuberculosis when more conservative action has yielded no result. There must, of course, be a most rigid selection of cases. In fact, this is the heart of the whole matter: the success or failure of the individual operator. Indeed, the final decision as to the permanent value of surgery in this connection depends upon it.

Selection of Cases Suitable for Operation.—What, then, is the criterion by which this selection can be properly carried out? Alexander, perhaps the leading authority on the surgery of tuberculosis in this country, says:

"In general, those patients are chosen for operation who have moderately or far advanced chronic tuberculosis, with or without hemoptysis; whose lesions are of the fibro-ulcerative type, with or without cavitation or empyema, and are principally confined to one lung; whose general condition, heart and individual resistance to tuberculosis are fairly good and in whom all other treatment, including a sufficiently long sanatorium regime and attempted artificial pneumothorax, have failed."

The tabulation of indications which serves Hedbloom includes chronic unilateral fibrosis of phthisis; adhesions preventing artificial pneumothorax; persistently recurring sterile effusions; fixation of the lung inhibiting expansion after pneumothorax; infected empyema; excessive displacement of the mediastinal structures after healing of tuberculous foci; and severe or recurrent hemorrhage in patients presenting adhesions which make artificial pneumothorax impossible. Archibald gives preference to the patient in whom is found "chronic,

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†Chief Surgeon, Welch Hospital No. 1.

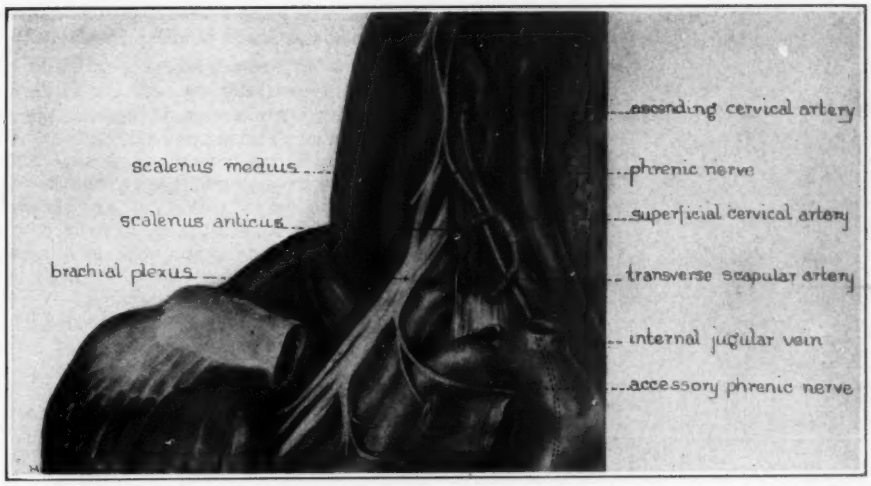

Fig. 1
Anatomy of the neck showing the phrenic nerve in its anatomical position.

chiefly unilateral, fibrotic and ulcerative tuberculosis, uncomplicated by any active process in the other or good lung." Such patients he designates as "good chronics." He prefers to operate upon these, but does not refuse "chronics who are slipping," that is, who present the same general picture as the first class, but with more extensive and active lesions. And to these he adds likewise the "bad chronics," those in whom the disease is steadily advancing though apparently limited fairly well to one lung. Though most of this last class is doomed already, the fact that some remarkable ameliorations and even cures have been reported when operation has been undertaken in the face of such overwhelming odds, makes those whose skill and experience best qualifies them to judge, advocate surgical measures as offering the sufferer the only possible chance of life.

The consensus of opinion, then, appears to be that the type of patient best suited for operative intervention is one whose tuberculous lesions are chronic, whose resisting powers are evidenced by the existence of a considerable amount of fibrosis, so that the process can be considered fairly well limited, and finally, whose general systemic condition is sufficiently good to give promise of being able to withstand the strain of an operative procedure.

The Surgeon's Aim in Operating.—While numerous procedures have from time to time been undertaken in the presence of tuberculous pulmonary lesions, I shall attempt to deal with but two, namely: extrapleural thoracoplasty and avulsion of exeresis of the phrenic nerve. These two procedures are now in sufficiently common use to permit comparison and evaluation of the results obtained by different operators. Their employment is no longer ranked as an innovation to be tested or ignored according to individual preference. They have become an established feature of the therapy of pulmonary tuberculosis and must be reckoned with as such. It is no longer a question whether or not surgery should ever be used. It remains to decide whether or not it is applicable to any particular case which may come under observation.

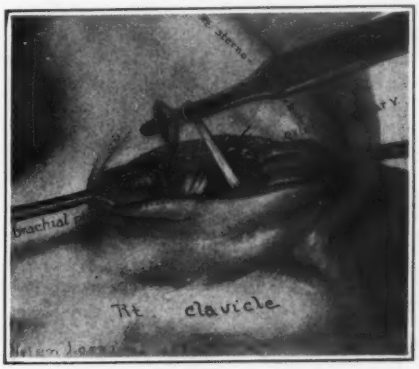

Fig. 2
Evulsion of the phrenic nerve.

Fig. 3
Alexander's method of crushing the phrenic nerve. The phrenic nerve has been crushed and he is now crushing the subclavian to get a more complete paralysis.

Very early in the evolution of what we are accustomed to call the modern treatment of tuberculosis the necessity of as complete physiological rest as possible was recognized. By inhibiting all the patient's activities the affected lungs were relieved of much of their burden. The employment of surgery to put the affected lung completely at rest is merely a logical extension of this same line of treatment. It is still very generally conceded that artificial pneumothorax is the best method of securing such rest for the lung, and thoracoplasty is only to be employed when the presence of adhesions or other adverse conditions render pneumothorax inexpedient or impossible. A few men of wide experience, notably Hedbloom, dissent from the general opinion, feeling that thoracoplasty may under certain rather restricted conditions be the treatment of choice whether or not pneumothorax is possible.

"In such cases the prospects of re-expansion of the lung are *nil*, the risk of ultimate secondary infection of a persistent pneumothorax cavity considerable, and the hazard of thoracoplasty collapse is relatively small."

In the exudative type of lesion, which may be regarded as one extreme, artificial pneumothorax collapse is the only procedure to be considered; in the chronic fibrotic type, the opposite extreme, thoracoplasty is emphatically indicated. There remains, as a sort of no-man's-land between these extremes, a large group of patients upon whom thoracoplasty is to be employed "only when artificial pneumothorax has been tried and found wanting."

Technic of Pneumolysis.—As artificial pneumothorax is generally regarded as a medical procedure, its consideration is beyond the scope of this paper. Phrenic exeresis, while sometimes used alone, is much more commonly employed as an adjunct to thoracoplasty, and so will be considered only in this light. Brief mention must also be made of the cautery procedure which is now coming into use as a means of getting rid of the adhesions which often render artificial pneumothorax incomplete. While this has not, as yet, found a very extended employment in this country, it has been used for some time in Europe, Jacobaeus, of Stockholm, having first undertaken it in 1913. A thoracoscope devised by Unverricht in 1922 is a decided improvement over that of Jacobaeus, at least in so far as the range of vision possible is to be considered. At present a combination of the two methods, such as has been brilliantly practised by Dr. Ralph C. Matson, of Oregon, seems to give the best results. The burning of adhesions under thoracoscopic control naturally requires surgical skill of the highest order. This, together with the elaborate system of observation and control which is necessary, requiring stereoscopic examination and continued fluoroscopic inspection, in addition to the routine pro-

Fig. 4
Incisions for thoracoplasty showing the incisions for the two stages.

cedures connected with pneumothorax, limits this particular branch of surgery to the large, well equipped institutions.

Technic of Cauterization.—So impressive are Matson's figures as to the length of life of patients upon whom complete pneumothorax was possible as compared with those in whom adhesions prevented obliteration of the cavities, that the method should certainly receive attention. Indeed, any way by which this very grave hindrance to the proper performance of so beneficial a therapeutic measure can be removed ought to have thoughtful consideration from even the most conservative. The procedure consists in the introduction of a thoracoscope through an incision in the chest wall by means of which the topography of the previously induced pneumothorax cavity may be carefully studied. The site of adhesions which prevent the pneumothorax from being complete having been ascertained before hand from stereoscopic films, their position is investigated and confirmed. Following this inspection, a second incision is made for the cautery, the exact point of entrance being determined by the thoracoscopic findings.

"Keeping in mind the location of the adhesion to be burned, the tip of the cautery is kept in the field of vision of the thoracoscope, while the eye-piece is rotated so as to bring the adhesion into view."

Matson's success with this method has been remarkable. He does not hesitate to say that had he employed it earlier, he is convinced that many patients whom he lost would have survived.

Anesthesia.—The question of anesthesia for surgery of the tuberculous chest has remained a rather vexed one. Local anesthesia has been used more extensively than any other form, but it is never entirely satisfactory. Some operators object to working upon a conscious patient, and to them the newer methods of nerve-blocking are equally objectionable. Ether is naturally contraindicated whenever pulmonary complications are present, while chloroform can be employed only when the heart is intact, and this is so seldom the case in the class of patients with whom we have to deal that for practical purposes its use cannot be considered.

Whatever means of anesthesia we employ, its administration should be carried out only by some one especially skilled in the work. No subject is more difficult to handle than the tuberculous one, and no novice should be permitted to induce anesthesia under these circumstances. The blood pressure must be taken frequently

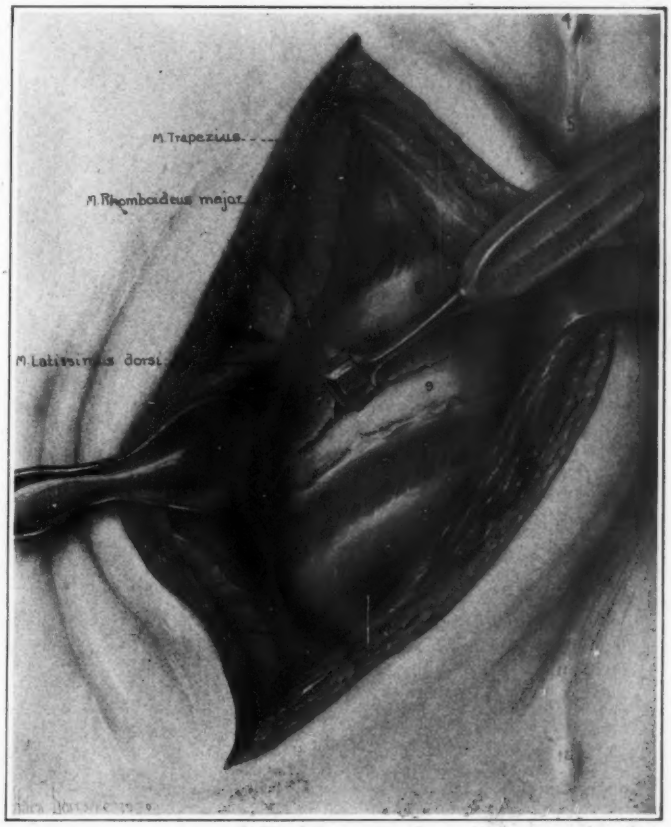

Fig. 5
First stage of thoracoplasty showing the periosteum being stripped from the ribs.

while the intervention is going on. It must be constantly borne in mind that ventilation within the lungs is greatly diminished and that this makes proper anesthesia difficult to maintain when any general method is in use. Nitrous-oxide-oxygen seems to have the preference for a general anesthetic and has much to recommend it. Especially is this true if it can be combined with a regional field block of the intercostal nerves. This should follow along the line of the angle of the ribs.

Phrenic Evulsion.—When pneumothorax fails because of adhesions which for various reasons cannot be eliminated, or when other of the prerequisites already mentioned are in existence, the advisability of employing thoracoplasty must be considered. The particular procedure now generally employed, which seems to give the best results in the majority of patients, is the extrapleural paravertebral intervention perfected by Sauerbruch. Most operators prefer to precede this by exeresis or evulsion of the phrenic nerve, bringing about temporary paralysis of one side of the diaphragm. Division of the phrenic nerve was formerly carried out after the ribs had been resected, but more recent practice seems to favor its employment as a preliminary step. This produces a more gradual collapse of the lung than would otherwise be possible, and likewise gives the operator valuable data as to the benefit he can expect to accrue to his patient from the more complete collapse which will be brought about by resection of the ribs.

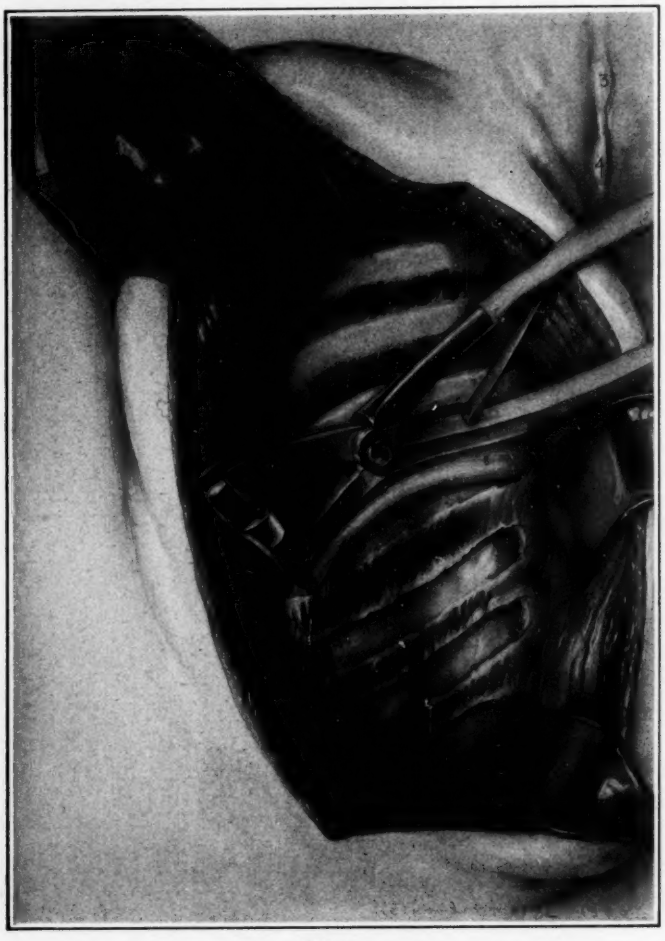

Fig. 6
Second stage of thoracoplasty showing the ribs which have been stripped of muscles and periosteum and are ready for resection.

"This operation is a simple one," according to Lambert and Berry, "performed under local anesthesia, and often will alter the local conditions sufficiently to allow the patient to combat his disease so successfully as to render him a far better operative risk."

Alexander does not regard the procedure so lightly. He says:

"Identification of the nerves deep in the base of the neck is occasionally very difficult, especially when their arrangement is abnormal. In spite of frequently heard statements to the contrary, the operation may prove dangerous or even fatal in either execution or effect. The vagus, long thoracic and sympathetic nerves by mistake have been cut, the brachial plexus has been wounded, the thoracic duct torn, the dome of the pleura opened, and the large arteries and veins wounded. Surely the operation should not be undertaken by anyone untrained in general surgery."

This warning, coming from so eminent an authority, may well indeed be

heeded. He has recently devised a new procedure which gives adequate exposure of the nerve and permits division and the evulsion of the distal portion. Temporary total paralysis of the diaphragm which will persist three or four months is best obtained by thoroughly crushing the main phrenic trunk with a hemostat and either crushing or excising a portion of the accessory phrenic.

Thoracoplasty.—The main operation of thoracoplasty consists in resection of the first ten ribs, rarely as high as the twelfth, and is usually performed in two stages. Authorities differ as to whether it is better to begin with the lower ribs, resecting perhaps to the sixth at the first session, and about two weeks later completing the resection as high as the second rib; or to follow the plan advocated by Lambert and Berry, that is, to resect the upper ribs first. They feel that they can secure a greater degree of collapse by this plan, and that it is not possible to obtain the full benefit from the fall of the ribs until the first rib has been taken out. This question, in their opinion, takes on added significance if the second stage must be deferred for several months,

"because by this time the resected portion of the chest wall (which in the upper limit is held out by the curve of the ribs above it) has become so stiffened and fixed that the fullest degree of collapse is not obtained after the second stage."

It is their custom to remove from 10 to 12 cm. of the lower ribs and a gradually diminishing amount as they proceed upward, until but 1 or 2 cm. are taken from the first rib. In Brauer's original technic the lower mid-ribs (fifth to ninth) were first resected, the tenth being left untouched so that it could support the diaphragm during the time immediately following resection. At a later date he performed phrenic exeresis, thus permitting relaxation of the expanded lung beneath the still intact tenth rib.

This procedure was later modified by Brauer, so that he removed from the upper ribs, with the exception of the first, far more substance than had been done in the older Wilm-Sauerbruch procedure. From the lower ribs he did not take away so much tissue. The first rib was only partially resected unless the apex had been drawn below it by the shrinkage of scar tissue. It is often unnecessary to resect the eleventh rib, as it is usually flexible enough to share the fall of the rest of the thoracic wall. If this rib is kept intact it serves to hold up the diaphragm and thus obviate the so-called diaphragmatic flutter, often mentioned as a serious drawback to thoracoplasty.

Conclusion.—It is impossible, in view of the brief time at my disposal, to introduce any imposing array of statistics to support my conten-

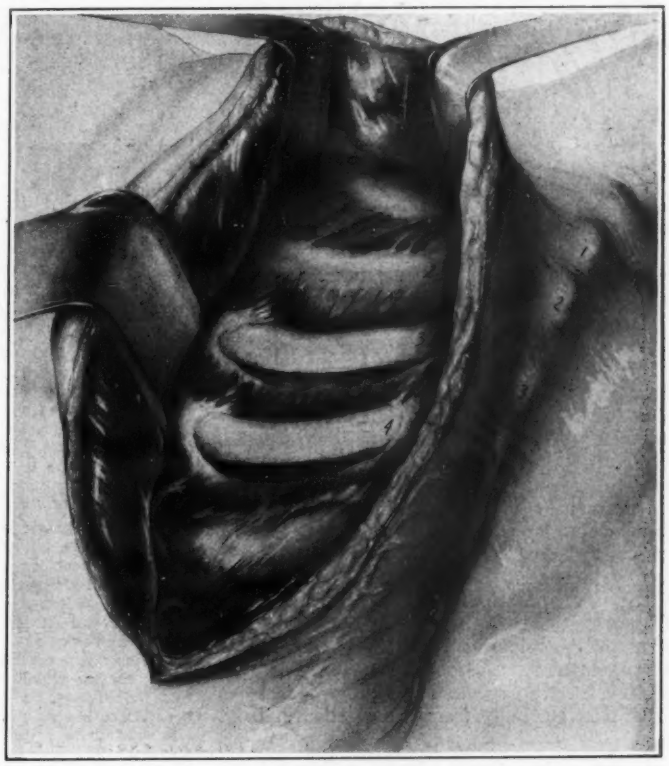

Fig. 7
Third stage of thoracoplasty with rib resector being placed in position. Note the two ribs above which have been resected.

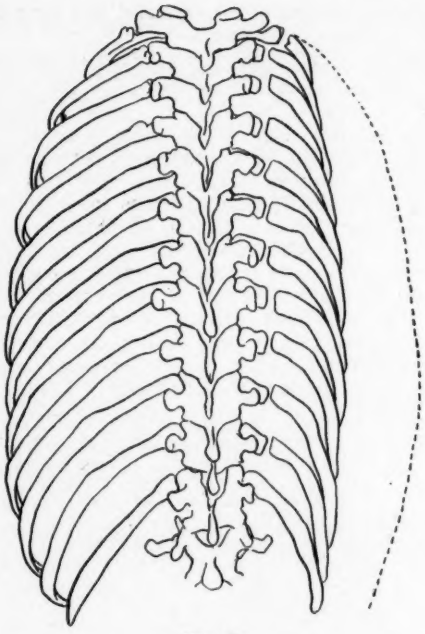

Fig. 8
A schematic drawing showing the collapse of the chest wall resulting from thoracoplasty.

tion that surgery in properly selected cases offers a hope to the sufferer from pulmonary tuberculosis far brighter than anything heretofore held out to him by the medical profession. I have tried to sketch very superficially some of the most frequently used means of surgical relief to these patients, and especially to emphasize how much may be accomplished for those who, only a few years ago, we should have been obliged to let perish without help. The pictures which I am showing will offer a clearer idea of the modes of procedure than could be conveyed by any description of mine. While most of this work undoubtedly demands a high degree of surgical skill and courage, this, in itself, should offer no insurmountable barrier to the alert practitioner, and all who have the best interests of their patients at heart should exert themselves to foster interest in this manner of handling pulmonary tuberculosis, for in this way we may shortly hope to see a decided decrease in the total mortality from this dreaded malady.

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Welch Hospital No. I

DISCUSSION (*Abstract*)

Dr. Paul H. Ringer, Asheville, N. C.—I am not a surgeon in any sense of the word, but a medical man, though for some years I have had a great deal of interest in the surgical management of pulmonary tuberculosis. I have been doing pneumothorax since 1912, and in the last few years I have taken advantage of other surgical procedures, such as Dr. Rutherford has mentioned in his paper.

I have come to believe that phrenicotomy is a very valuable procedure. Naturally one can never tell how much diaphragmatic rise one will get after a phrenicotomy. I have seen all manner of results from this operation, ranging from nothing to perfect and complete recovery, the latter, however, being rare. I have noted that in certain cases of persistent and harassing cough, often leading to vomiting after every meal, a phrenicotomy has been of great value in relieving this troublesome symptom. This is particularly the case if a left-sided operation can be done.

I have been much interested in pneumolysis and two years ago spent ten days with Dr. Ralph Matson, of Portland, Oregon, and saw him do 4 cases. This procedure involves a great deal of skill and should not be undertaken unless one is equipped with the best of apparatus and has had long practice in orientation within the thoracic cavity. The thing that pneumolysis makes us realize most is how little the x-ray reveals as to the matter of adhesions. I recall one case which I saw Dr. Matson do in which the x-ray revealed two beautiful adhesions which prevented a cavity from collapsing, and before the operation was ended nine or ten adhesions had been severed. One cannot be certain what one is going to find on looking into the pneumothorax cavity through the thoracoscope.

The results that I have seen in thoracoplasty have

been thoroughly satisfactory, but one must realize that it is a serious operation and that the patient must look forward to spending many weeks in a hospital and must have the benefit of expert nursing care during the entire stay. There is no field of surgery in which cooperation and constant consultation between the medical man and the surgeon are of more importance than in these cases of actual or prospective lung surgery. It is a great boon to the medical man that the surgeon has come to his aid so prominently in this matter of chest surgery and has given to the patient with advanced tuberculosis a chance to be restored to health and to economic efficiency.

Dr. Wallace Frank, Louisville, Ky.—There are two or three points that I would like especially to bring to your attention. I am of the opinion that crushing of the phrenic nerve instead of phrenicotomy should be employed in cases having bilateral lesions where there may be a question of the need of surgery in the good lung. If the effect of the crushing begins to be lost and the good lung is in satisfactory condition phrenicotomy may then be employed. We have performed bilateral phrenicotomy in several cases with relatively small inconvenience to the patients. We believe, however, that the conservative method of phrenempraxis should be employed before undertaking bilateral operations.

Our experience with phrenicotomy embraces some 250 or 260 cases, and in this number very good results have been obtained in more than 50 per cent. Last year before the Southern Surgical Association in Atlanta we reported a detailed study of 100 cases of phrenicotomy and in that series, all of whom were far advanced, we had 8 cures. By cures I mean that cough ceased, expectoration ceased, cavities became closed and the tubercle bacilli disappeared. We had another 40 per cent in which there was marked improvement with great diminution in the size of the cavities or disappearance.

As Dr. Rutherford mentioned in his paper, this operation, phrenicotomy, looks simple and yet it may be exceedingly difficult. The phrenic nerve takes its origin from the cervical roots and unfortunately the position of the nerve varies greatly and at times it is exceedingly difficult to find. On Tuesday in the Clinic at the City Hospital we had 2 cases in which the phrenic nerve did not cross the scalene muscle at all, but proceeded downward into the chest along the outer border of the muscle. The origin of the nerve in these cases was low in the neck and the nerves were very near the position of the nerve to the subclavius muscle.

There is one relatively sure way of identifying the nerve when it is found and that is by the fact that the patient complains of pain in the shoulder when the nerve is stimulated. Accessory nerves are not uncommon and in our later work we carefully search for these, as it was necessary to re-operate upon a few of the earlier patients because of failure to section the accessorics. We now not only evulse the phrenic nerve and section the accessories, but also search for and divide the nerve to the subclavius muscle, through which may come the chief innervation of the diaphragm.

The result of phrenicotomy depends upon the height to which the diaphragm rises. It has been our experience that the rise of the diaphragm has been greater on the left side than on the right.

In a certain number of individuals it will be noticed upon using pneumothorax that the mediastinum will shift into the other side of the chest. In such individuals it is useless to do thoracoplasty because of the fact that sufficient compression cannot be obtained. In these cases we believe that thoracoplasty should be postponed until the mediastinum becomes fixed.

We agree with the essayist that the multiple stage method of thoracoplasty is by far the safest way to do this operation. Whether it is better to begin the operation at the bottom or at the top is still a mooted point. In cases where, in the surgeon's opinion, the stages will be relatively short, we believe it best to start with the removal of the upper ribs. In most cases the cavity is in the top of the lung and by early compression the possibility of re-infection of the good lung is obviated. In cases where the interval between the stages will be long and there is likelihood of bone regeneration before the second stage is done, we believe it is better to begin thoracoplasty with the lower ribs. It is a difficult procedure at best to re-operate and remove the same ribs at a second sitting, and when this has to be done with the upper ribs the technical difficulty is exceedingly great.

Dr. D. C. Elkins, Atlanta, Ga.—Dr. Ringer has admitted something that medical men refuse to admit: that tuberculosis can be helped by operative procedures. We have found great difficulty in getting medical men to allow patients to be operated upon until they are in the very last stages of tuberculosis.

If surgery is of value in curing 10 per cent of Dr. Ringer's cases of advanced tuberculosis, it would be of far more value in treating early cases.

I have recently seen a case treated by an excellent physician five months without improvement which phrenicotomy cured in two months.

There are some cases in which the nerve can not be found. Usually it can be found, and where the diaphragm does not rise after it has been crushed, we have probably not found the phrenic nerve, but have operated upon another nerve.

Dr. M. Casper, Louisville, Ky.—If you operate upon the lower chest, first it is important to get complete anesthesia. You can get complete anesthesia on the lower ribs, thus you get the patient's confidence. For the second stage, when it is more difficult to secure perfect anesthesia, we find a small dose of spinal anesthesia very beneficial along with the local anesthesia. For a right-sided operation you should keep the patient right side up, lying on his side from five to seven minutes after the spinal anesthesia is introduced. Your anesthetic, then, will be confined almost entirely to the right side of the lower chest and upper abdomen. We do the same thing in an operation for appendicitis or any other right-sided incision. I am not one who advocates spinal anesthesia for the removal of tonsils, but believe it is a great aid in combination with local in this class of work.

Dr. Rutherford (closing).—I hope I have made myself clear as to the complete and permanent paralysis of the lung on the side on which the phrenicotomy is done. After the phrenic nerve is exposed you may crush or completely traumatize it with hemostatic forceps which produces a complete paralysis which is temporary and lasts for only a short while. You may cut the phrenic nerve and also get a complete paralysis, lasting, in all probability, somewhat longer than the one you traumatize. You may cut and evulse or pull out from an inch to three inches of the phrenic nerve and get a complete and permanent paralysis. Evulsion is the only sure way of producing a permanent paralysis.

A POINT IN THE DIAGNOSIS OF FOCAL SUPPURATIVE NEPHRITIS*

By HENRY S. BROWNE, M.D.,
Tulsa, Okla.

In this country Brewer[1] was the first to familiarize us with this condition under the name of "Acute Unilateral Septic Infarcts of the Kidney." The presence in the blood of pathogenic micro-organisms capable of producing metastatic infection in the kidney may, according to Israel, arise from absorption from the intestines, from acute infectious diseases, from local suppurations, and also from infections of the lower urinary tract. In a large number of instances of hematogenous infection the renal lesions are unilateral because of the diminished resistance of one kidney due to disease or injury (calculus, obstruction, trauma, ptosis, et cetera). Brewer[2] later experimentally produced lesions identical with those found in clinical cases of hematogenous origin. In most instances they were due to a plugging of the arteries and capillary vessels with groups of organisms. These minute emboli are then surrounded by a zone of round cell infiltration. When the larger trunks are occluded triangular infarcts are present. Where the capillaries only are involved, minute abscesses are seen throughout the cortex and beneath the capsule. As the infection goes on, areas of necrosis and purulent infiltration are found, and at a still later stage many of these collections of pus coalesce, forming larger parenchymatous abscesses which may rupture through the capsule, causing perinephritis, or into the pelvis, causing pyonephrosis. We know that during the course of an acute infectious disease organisms enter the blood stream and many are excreted via the kidneys. If the number of these organisms is large and their virulence high, and one or both kidneys has its resistance lowered by trauma, calculus or other abnormality, the lesions may be produced which have been described above. While the disease may be bilateral, in a large number of instances it is unilateral. Brewer was able to produce these lesions in animals by the *B. coli, Streptococcus pyogenes, B. typhosus, pneumococcus and B. pyocyaneus.* In clinical cases he could isolate only the first four of these organisms. Clinically, the acute onset of this type of renal infection simulates ruptured peptic ulcer, acute cholecystitis or appendicitis, and this similarity has frequently led to errors in diagnosis. There is usually a chill, followed by a rapid rise in temperature and a fast pulse. Marked toxemia and a high leucocytosis develop rapidly. Pain, tenderness and rigidity on the side of the affected organ are present, and lumbar tenderness, rigidity and spasm are most significant. The abdominal signs are those of an acute surgical abdomen. Vomiting may occur early and be pernicious in type. The enlarged kidney may sometimes be palpable. When infection is severe the patient grows rapidly worse, toxemia is profound and the patient dies, unless nephrectomy is carried out. Cunningham and Graves[3] emphasize the fact that often the urine is quite normal, because the abscesses find no avenue of escape through the collecting tubules, which are plugged by products of inflammation or compressed by the infiltrated tissue surrounding them. It has not been emphasized that there is a sudden enlargement of the kidney to several times its normal size, and that the renal capsule, confining the organ, causes a great increase in intrarenal tension, which would lead, naturally, to compression of the pelvis. The calices, being surrounded by cortical tissue, filled with these multiple minute abscesses, would be compressed and possibly obliterated. As the pelvic mucous membrane is not infected, its outline would remain clear cut. These premises are

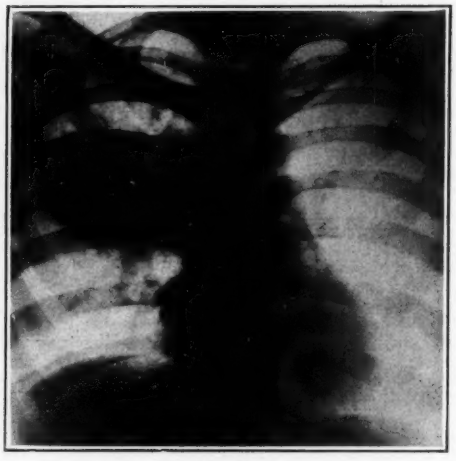

Fig. 1
Primary focus of infection in right lung.

*Read in Section on Urology, Southern Medical Association, Twenty-Fourth Annual Meeting, Louisville, Kentucky, November 11-14, 1930.

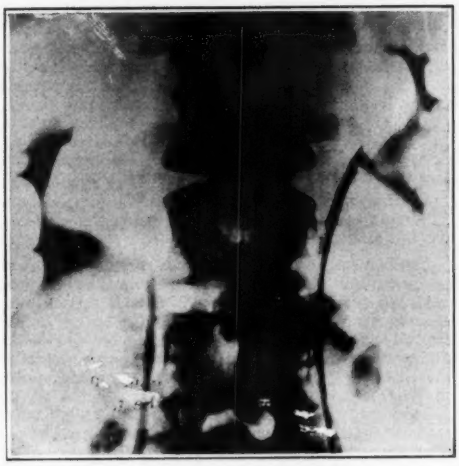

Fig. 2
Normal left pyelogram. Right pyelogram shows compression of pelvis and obliteration of calices.

borne out in the pyelogram of the case here reported.

CASE REPORT

Catherine B., a white, single girl, age twenty-two, was perfectly well up to May 26, 1927, when she was taken ill with a chill, high fever and rapid respiration. She was seen at this time by Dr. Samuel Goodman, who made a diagnosis of right pneumonitis. At that time neither kidney was palpable nor tender. Her temperature remained high, but went to normal on June 4, to rise again two days later, when a left otitis media was drained. From the beginning she was able to retain little food on account of persistent vomiting. On June 15 the right kidney was found to be considerably enlarged and tender. Gastrointestinal x-rays were negative. The patient was seen by me on June 20, at which time she was quite emaciated and weak. The right kidney was definitely enlarged and tender. On cystoscopy the bladder was found to be normal. Both ureters were catheterized easily and pus was obtained from both kidneys, *B. coli* being found on culture from each. Phthalein output showed 5 per cent from the right kidney and 15 per cent from the left in fifteen minutes. The left pyelogram was normal and the right showed marked compression of the pelvis and obliteration of all the calices but the upper one, there being merely indentations in the pelvis to show their former location. The pelvic outline was clear cut. The left pyelogram being normal, and the function of that kidney being normal, it was decided that only a simple pyelitis was present there. From the compression of the right pelvis and obliteration of the calices, a diagnosis of intrarenal infection, probably abscesses, was made. Blood counts throughout ranged from 21,000 to 26,500 and the red cells totaled 3,800,000 with a hemoglobin of 72 per cent. Following cystoscopy she was treated expectantly for one week, but grew steadily weaker and more emaciated, as pernicious vomiting and the septic temperature still persisted. Right nephrectomy was therefore carried out on June 30. The kidney was found to be greatly enlarged, weighing 350 grams, and very nodular, being studded with numerous small, grayish areas beneath the capsule. On gross section the entire cortex was involved with these areas of necrosis. No free pus was present, however, and the upper pole was much less involved than the remainder of the kidney. These areas were present in the cortical columns, extending down between the pyramids and calices. On microscopic examination by Dr. I. A. Nelson, the glomeruli were found greatly degenerated and the tubules to have undergone hyaline decomposition, with many of them plugged with hyaline material. Interspersed throughout were many massed leucocytes. Following the operation there was considerable shock, but in forty-eight hours vomiting ceased and she began to take nourishment.

Convalescence was uneventful thereafter and she was discharged on the fifteenth postoperative day. Two weeks later acute pyelonephritis developed in the remaining kidney. This was easily controlled by an inlying catheter. Repeated catheterized specimens of urine since that time have failed to show pus or bacteria, and the patient is entirely well.

COMMENT

In focal suppurative nephritis there is a sudden increase in the size of the kidney to several times normal. The renal capsule, confining the organ, causes a great increase in the intrarenal tension, which leads to a compression of the pelvis. The calices being surrounded by the cortical columns filled with minute abscesses are partly or wholly obliterated by the swollen and inflamed kidney tissue. The pyelogram, as observed in the above case, will show compression of the pelvis and obliteration of one or more calices. The diagnosis, which is often obscure, is therefore greatly clarified.

Fig. 3
Multiple minute suppurative foci throughout kidney cortex.

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2. Brewer, George E.: J.A.M.A., pp. 179-187, July 15, 1911.
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DISCUSSION (*Abstract*)

Dr. Robert E. Cumming, Detroit, Mich.—Dr. Cabot and his staff at the University Hospital at Ann Arbor have been studying cases of renal infection in an effort to determine pre-existent foci elsewhere, and with the theory that in a large proportion of cases the focus existed in the upper respiratory tract. In a surprising number of examinations made early in the course of renal invasion, organisms other than those of the *B. coli* group predominated, principally staphylococci and streptococci. Direct smears made of the urine sediment show these organisms, when cultures may produce only the colon group, which is more viable on artificial media.

Naturally, in the type of case under discussion, the pre-existent focus of infection is all-important, as are the other disposing causes mentioned by the essayist; and it would appear that the upper respiratory passages are more prone to institute the preliminary bacteremia than foci on the skin, such as furuncles, which, with other surface infections, give rise to the so-called kidney carbuncle. However, I have not always been able to differentiate between a single carbuncle and a more or less diffuse unilateral septic infarction, nor do I believe that pyelography will make a distinction here. Dr. Browne's own pyelogram illustrating his point in diagnosis might be interpreted as indicating a single massive area of disease. In differential diagnosis Brewer stressed the importance of an antecedent pneumonia and the case just reported had such a preliminary diagnosis.

In one of my own cases pneumonia was suspected, in another a septic sore throat, and in another appendicitis. To me the most important physical sign has been a well-localized area of extreme tenderness in the costo-vertebral angle.

I must confess, however, that I have not made a sufficient number of pyelograms in instances of "Brewer's kidney" to come to a definite idea as to the constancy of pelvic deformity, which will depend purely upon the location of the abscesses, their size, and the reaction resultant in adjacent tissue. In the small series of cases I have observed personally, the patients have been so ill, the history and physical findings so definite, that pyelography seemed to involve unnecessary risk. On the other hand, when the diagnosis is obscure, I should judge pyelography to be of extreme importance, and Dr. Browne's patient required careful differentiation. It was also important to visualize the pelvis of the opposite kidney. Many of the patients with a diagnosis of "unilateral hematogenous infection of the kidney" (Brewer's term) prove to have bilateral involvement and not a few succumb after too eager nephrectomy. Decapsulation and multiple incisions may apply in the treatment of these cases.

There are several other conditions which give a pyelographic outline comparable to that described by the author. An early tumor, or one with beginning pelvic encroachment only, partial filling of a normal pelvis, with excessive pressure upon one calyx, or an induced spasm of all or part of the pelvis and calices, and the presence of an organized blood clot, may allow clear-cut outline of the pelvis and fragments of calices, so that, as maintained by Dr. Browne, while pyelography should clarify the diagnosis of the unilateral septic kidney, other points are still of the utmost importance. One might hope for information along this line by means of intravenous pyelography, but my opinion, based upon considerable experience, is that such a kidney will not excrete the media in sufficient amount and regularity to offer any dependable aid.

A more hopeful method for accurate interpretation of all urographic studies has been developed by us with the use of the cinex camera.

Dr. Thomas D. Moore, Memphis, Tenn.—Dr. Browne has stated in his excellent presentation that the focal suppurative nephritis described by Brewer may be either hematogenous or urogenous in origin. He has stressed the value of pyelography in the diagnosis of this condition and has pointed out the mechanism by which the changes in the pelvis and calices are produced, that is, by an increase in intrarenal tension due to the unyielding capsule in the presence of an inflammatory swelling of the renal parenchyma which exerts itself in compressing the calices and pelvis. The case he presents seems to illustrate very clearly that this actually occurs. It is my impression, however, that such a change occurs comparatively late, and it is generally known that many patients with this disease are very ill from the onset and that prompt surgical treatment within the first few days of the illness is necessary to conserve life. It is noted in his case that the pyelogram was made in the fourth week of the illness. As an early diagnostic measure it probably will not be of great value because the necessary changes to produce the compression he describes will not have had time to occur. Probably of greater value in the early recognition of the acute cases of focal suppurative nephritis are the following: (1) rigors repeated at frequent intervals associated with hyperpyrexia; (2) marked tenderness and rigidity over the region of the affected kidney; (3) failure to respond to continuous drainage by inlying ureteral catheters; (4) high leucocytosis, as a rule above 20,000.

Several years ago it was my privilege to observe a case of urogenous origin following pyelography in the presence of a small hydronephrosis. An autopsy disclosed metastatic suppurative foci in the spleen, lungs and elsewhere, and the case emphasizes the necessity for prompt recognition of the disease before it has progressed to a pyemic state.

It is important that focal suppurative nephritis should not be confused with large abscesses, single or multiple, of the renal cortex, or with renal carbuncle. In the latter conditions the disease runs a much longer course, and in the case of carbuncle a prolonged period of time. In some cases as long as six months or more may elapse between the initial superficial suppurative lesion, such as a boil or paronychia, and the symptoms referable to renal involvement. In these cases pyelography displays no characteristic changes. The pyelogram in focal suppurative nephritis is not without danger and may greatly aggravate or even spread the infection through pyelovenous backflow. Retrograde pyelography is probably never justifiable in the very acute cases.

Dr. W. J. Wallace, Oklahoma City, Okla.—The symptoms of these cases are so varied and simulate so many other diseases that they are very often overlooked by physicians who do not specialize in urology. If the

patient is a child, usually among the first symptoms will be a gastrointestinal disturbance, then acute fever, grippe or perhaps some intra-abdominal trouble, and the real condition is overlooked. In an adult, a confusing cholecystitis, subfrenal abscess, appendicitis or some pelvic trouble may be suspected, and the last thing to be considered is a kidney condition. When the symptoms are far advanced the urologist is called in for a differential diagnosis.

The history should be carefully taken. Then the symptoms should be noted such as fluctuating temperature, the character of the blood count (which should be made daily), the urine (which should be analyzed daily, as it gives valuable information). The physical examination will always reveal marked tenderness over the costo-vertebral space and extending around underneath the costal margin. We also find gastrointestinal symptoms such as nausea and vomiting.

In the diagnosis we should go further; the urine, I believe, if collected properly, will give us valuable information. So the patient should be cystoscoped, the catheter passed, the urine collected for a differential and the function determined. I do not believe that a pyelogram should be made. It is my rule never to make a pyelogram in any acute or suspected acute renal condition. Uroselectan will be very helpful in such a case, and I would depend on it instead of a retrograde pyelogram. Uroselectan is safe and will give a very definite outline of the kidney pelvis and calices.

I wish to agree with Dr. Browne that the kidney is always enlarged and very often can be palpated, especially in slender women.

I do not believe that a nephrectomy is indicated in every case. Many cases can be cured under proper therapeutic treatment associated with rest. But if an operation is indicated it must be done at once, for delay may be fatal.

Dr. T. M. Davis, Greenville, S. C.—The giving of intravenous uroselectan has been mentioned. With the infected kidneys under discussion I would not inject 100 c. c. of a 40 per cent solution intravenously. If extra precaution is used in injecting the renal pelvis, retrograde pyelography is preferable. I find that a 10 per cent solution of uroselectan is excellent for this purpose, as it is non-irritating, and it is secreted through the kidneys in about this concentration, which gives excellent detail. Forty grams will make 400 c. c. of solution for this purpose.

In differentiation of perinephritic abscess you will find in about 75 per cent of cases a curvature of the spine with the concavity towards the affected side due to the muscular spasm on this side, also obliteration of the angle between the lower pole of the kidney and psoas muscle. Later there will be changes in the pelvic contour.

Dr. Courtney W. Shropshire, Birmingham, Ala.—The consensus of opinion today is more towards the conservation of organs, kidneys especially, than it has been in years gone by.

The radical treatment of this condition is the removal of the infected kidney. Badly infected kidneys may be saved by drainage and pelvic lavage with 1 per cent mercurochrome, using 1 per cent mercurochrome intravenously as well, if one watches the patient and has blood cultures, blood chemical analyses, white blood counts, microscopical examination and cultures of ureteral catheterized urine.

My experience in making radiograms with uroselectan has not been very satisfactory, but as a urinary antiseptic it has proven most beneficial in bilateral pyelitis. I remember a woman recently admitted to the Norwood Clinic and Hospital with a bilateral pyelitis to whom uroselectan was administered intravenously with no outline of the urologic tract, but a material decrease in pus in the urine.

Dr. John Caulk, St. Louis, Mo.—In the average pyelonephritics we have retention. The leukocyte count is always high, 20,000 to 35,000. In other kidney conditions it seldom goes higher than from 15,000 to 18,000. This is important in diagnosis.

No kidney will give an accurate function when it is sick. So we discredit the functional test in a sick kidney. We cannot say that a kidney is dead because it is 3-5 per cent normal when it is infected. A kidney of that type will come back and is perfectly capable of good function later.

These patients are so sick that we are afraid to operate upon them; and we find that they get well if we use all of our facilities, giving them heat to allay the acute inflammation. Most of these kidneys get well and do not require as much attention as other types of nephritic lesions.

Dr. C. E. Burford, St. Louis, Mo.—Pyelograms are essential for differential diagnosis and can be made with safety if a small amount of opaque fluid is injected and a pyelogram taken. If necessary more fluid can be injected in order to fill the calices and a second or third picture can be taken.

Definite elevation of the diaphragm on the affected side usually means perinephritic inflammation rather than focal infection in the kidney, but a recent experience has proven an exception to this statement. After all other tests are made we sometimes find it necessary to explore surgically before a differentiation can be made between perinephritic abscess and focal inflammation in the kidney.

Dr. Horace C. Gayden, Nashville, Tenn.—There is a new medium for intravenous pyelography which will come into our hands soon, an improvement on uroselectan. Uroselectan will soon be replaced by what Dr. Braasch is calling skiodan, which will be put on the market in sixty to ninety days by the Winthrop Chemical Company. At the Mayo Clinic 1,000 cases have already been examined by this means. There were no reactions, more vivid shadows and the entire urological tract was brought out without local irritation or systemic upsets. It may be used as a retrograde pyelographic medium like sodium iodide and it may be recovered from the urine and used again.

It is used in smaller quantities than uroselectan and it is promised that the price will be greatly reduced.

Dr. Browne (closing).—The literature on this subject is surprisingly scarce. I consulted some 27 references, and with the exception of Brewer's articles and a few others, they consisted only of case reports. As Dr. Cumming stated, Brewer makes no mention of pyelography, but we must remember that his work was done more than fifteen years ago, at which time a pyelogram was more feared than a nephrectomy. Some of us still seem to have that fear. In none of the literature consulted was a pyelogram referred to, nor have I been able to find a pyelogram similar to the one shown today in any text book or other article. I therefore considered it worth while to call your attention to the compression of the pelvis and obliteration

of the calices as shown in this case, which I believe will be found in other cases of this disease. The symptoms are not very clear-cut, the patient is very ill. Anything which will help clarify the diagnosis, when nephrectomy may be necessary to save life, as in this case, is of value. Pyelography was of very great help to me here, for in the face of infected urine from both kidneys I dared to remove the right kidney, solely because the left pyelogram was normal.

THE DEVELOPMENT OF THE EAR AND ITS RELATION TO OTITIS MEDIA AND MASTOIDITIS*

By JOHN F. TOWNSEND, M.D.,
Charleston, S. C.

Clinical pathology presents itself to memory's eyes as a bulky book containing many illustrations that we did not understand. I am hoping briefly to tell you a little by pictures that you can understand.

Having treated a large number of infants and children with otitis media and mastoid infection, I sought to find the answer to three questions, which are:

(1) Why otitis media and mastoid infections occur frequently in young life.

(2) How otitis media in children leads to serious deafness in adult life.

(3) Why mastoid infections more often lead to bone formation than necrosis of the bone.

The illustrations will make this clear. These illustrations are not from photographs. In some respects they are not anatomically correct. There was no attempt to make them so in every respect. But in so far as they illustrate the pathology and anatomy that formed the subject matter of this paper, I have endeavored to make them true, and would welcome any corrections on those features.

The first illustrates the infant and the adult Eustachian tube, middle ear and mastoid.

In *Plate 1*, the upper picture shows the infant Eustachian tube, middle ear, mastoid antrum and mastoid cells. The lower picture shows the same adult structures. In the upper infant picture the Eustachian tube is of a larger size, is horizontal, and is of course shorter.

In the adult the caliber of the Eustachian tube is much smaller. In the middle ear and antrum of the upper plate are many folds of mesodermal tissue. The antrum in the infant is of the same size as in the adult and is located higher. In the lower picture of the adult middle ear and mastoid antrum the mesodermal folds are gone.

In the infant the Eustachian tube is of a much larger caliber than in the adult.

In the infant the Eustachian tube normally: (1) provides for aeration, drainage and development of the middle ear and mastoid cells; (2) the larger size of the infant Eustachian tube predisposes to infection of the middle ear and mastoid, which infection occurs more especially from vomiting in infants or from upper respiratory infections, especially if associated with coughing, answering in part why the infant or child often has middle ear infections; (3) infection of the Eustachian tube and middle ear may lead to permanent deafness, of which 80 per cent can be cured if treated in childhood, according to Dr. Hay, of New York City.

Plate 2 is meant to represent a swollen mu-

*Read in Section on Ophthalmology and Otolaryngology, Southern Medical Association, Twenty-Fourth Annual Meeting, Louisville, Kentucky, November 11-14, 1930.

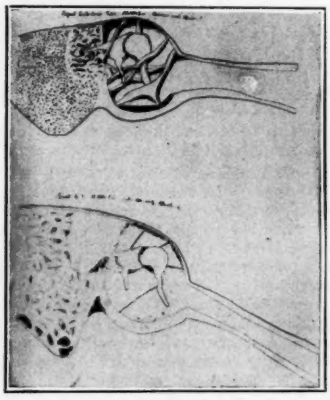

Plate 1

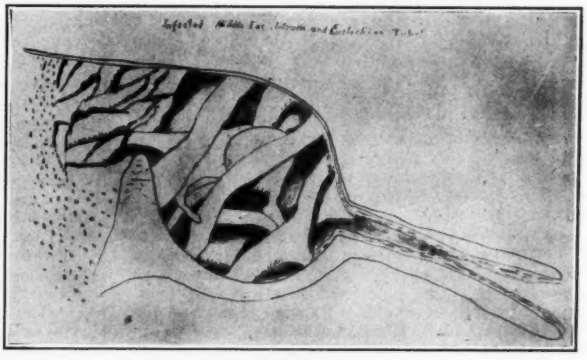

Plate 2

cous membrane of the Eustachian tube blocking it, and shows, among other things, why infections are common in young life. The mesodermal mucous membrane of the Eustachian tube, mastoid antrum and middle ear swell up and this swelling:

(1) Interferes with drainage.

(2) Prevents healing.

(3) Promotes infection of the middle ear and mastoid cavities.

(4) Being filled with mesodermal embryonic tissue, these membranes offer a poor resistance to infection. This is another reason why middle ear and mastoid infections occur more commonly in infants and children than in adults, and it is also why permanent damage to hearing often results from infections that occur at this age. These infections persist until permanent damage is done to the middle ear structures, which causes permanent damage to the hearing. On account of preventing the free entrance of air into the mastoid antrum, the swelling of these folds interferes with the development of the mastoid cells; for the development of these cells depends upon the air pressure's being in the mastoid antrum, as you will see later.

There are two types of middle ear infection: one with much edema of these folds; and the other with little edema. They require different methods of treatment and frequently have a different bacterial cause. I think that you are all familiar with those types of middle ear infection. In support of this classification I would say that Dr. Carmack found in 6 per cent of the 28 cases he reported (March, 1930) a very edematous mucosa of the mastoid spaces. I have found the same condition in some infants both at post-mortem and at operation (*Annals of Otology, Rhinology and Laryngology*, 1930, page 76).

Now with respect to why bone formation occurs instead of bony necrosis, *Plate 3* (top picture) represents the infant mastoid with no air cells present and (bottom picture) the adult mastoid with the air cells developed.

If these cells are not developed at least diploetically by the fifth year they will never develop later in life. The mastoid will always be of the bony sclerotic type, which emphasizes the importance of preventing infections in young life that interfere with the development of the mastoid cells. How the mastoid cells develop and how infection prevents that development the next illustration will show.

Plate 4 shows how the pneumatic mastoid develops.

Fig. 1 (top) shows how the air cells are formed by a budding out of epithelium from the mastoid antrum. The air pressure in the antrum is a big factor in pushing the buds out from the antrum. The mastoid cells develop from two centers, one from the mastoid antrum and the other

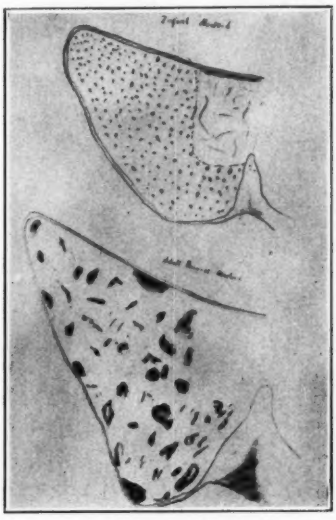

Plate 3

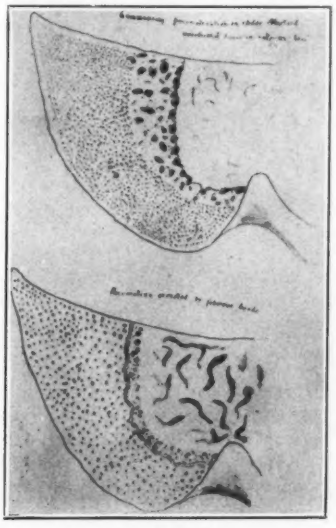

Plate 4

from the hypotympanic area, which is connected with the antrum by the sinus tympanici.

Fig. 2 (Bottom).—If an infection in the mastoid occurs we think, first, of a destructive necrosis of the mastoid bone, leading perhaps to meningitis, sinus thrombosis or some other such cheerful prospect. But the point that I want to emphasize is that bone formation is of a much more frequent occurrence. This increased bone formation occurs in children from arrest in development of the mastoid cells. It occurs as the result of the formation of a fibrous band, a band forming in front of the advancing cellular growth, as you will see in *Plate 4, Fig. 2.*

In adults, increase in bone occurs from a thickening of the trabeculae. In both cases, in infants and adults, there results the sclerotic mastoid that is hard to curette out. Practical results are shown on *Plate 5.*

In the lower picture is a shaded area representing a walled in more or less infected cell. If at any time in life this were to become acutely infected it would quickly rupture intracranially, emphasizing another danger of mastoids sclerosed from previous infection.

This increased bone formation

(1) Influences x-ray interpretation, for *Fig. 2* of *Plate 5* will always show dense by x-ray, whether it is infected or not. Hence, it is necessary to inquire if there has been at some time previously a middle ear infection.

(2) The surgeon cannot wait long before operating in the sclerotic type of case. The thick bone prevents an abscess in this type from rupturing externally, but there is no thickening of the inner plate to prevent the mastoid abscess from rupturing internally.

(3) The surgeon who knows his case better than the radiologist may advise against a mastoid operation after positive x-ray findings. He may know that a mastoid that has been exposed to previous inflammation shows a dense shadow, not on account of a present attack, but on account of the previous infection of the middle ear. If that is not clear, I can explain it.

Plate 6 shows the three types of mastoid: from above downward, pneumatic, diploetic and sclerotic. All these types are described in textbooks as normal variations, but I think that the first or pneumatic is the only normal one. The diploetic and sclerotic represent degrees of pathological damage due to a previously existing middle ear or mastoid antrum infection.

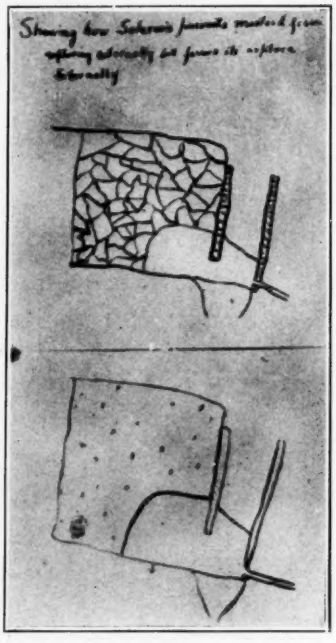

Plate 5

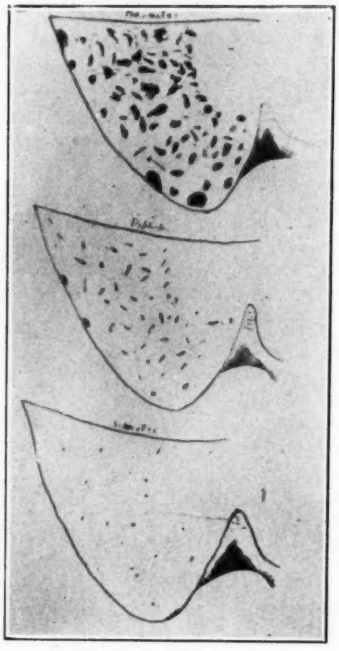

Plate 6

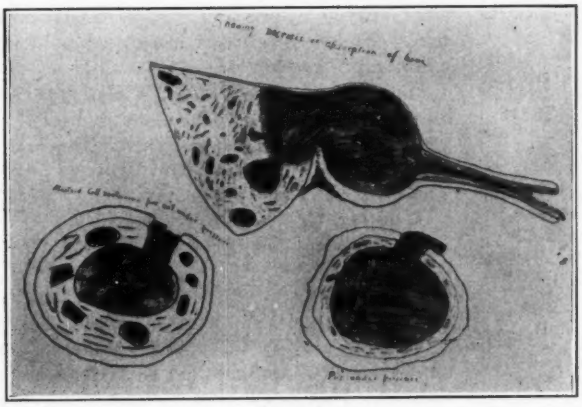

Plate 7

I have in mind a child of six years of age who has had a bilateral otitis media since four months of age. A recent x-ray report reads: "Mastoid sclerosed with little cellular tissues." So you see that a sclerosed mastoid may be found in early life, and it is going to be of that type for the rest of its life.

Plate 7 shows an infected mastoid.

Operative mastoid infections are of two general types: those (a) resulting in necrosis and those (b) without necrosis, but with a thrombosis of vessels, the hemorrhagic type.

(A) By *Plate 7* we can see why the necrosis of the mastoid bone occurs and understand how best to prevent it. Necrosis of the intercellular trabeculae occurs as the result of infection plus anemia from intracellular pressure. *Plate 7* shows us:

(1) Infected mastoid with an infected cell.

(2) An infected cell with pus not under pressure, with the mucous membrane of the cell thick and full of blood.

(3) An infected cell with pus under pressure, with the mucous membrane of the cell pressed out, the blood squeezed out of it, enemic, and the pus pouring out of the cell.

This emphasizes the value of:

(1) Free drainage in middle ear and threatened mastoid infection as a means of preventing intracellular pressure.

(2) Value of flaxseed poultices to prevent anemia in the trabeculae.

(B) In the so-called hemorrhagic type of mastoid there is no anemia and consequently necrosis is not found, either by x-ray or at operation.

Whether the mastoid is of the necrotic or of the hemorrhagic type depends to a great extent on the character of the infecting bacteria.

We are apt to think that a mastoid infection presents only one type of pathology, but the variation in the pathologic findings of the mastoid are important. Upon the differences in pathology depends:

(1) Difference in x-ray findings.

(2) Difference in symptomatology.

(3) Difference in indications for operation.

(4) And difference in non-operative treatment.

We are too apt to think in terms of symptomatology rather than on the more secure basis of pathology. And just as in middle ear infection treatment varies with the edematous and the non-edematous type, so in mastoid infection the surgical advice and treatment should also vary in accordance with the special clinical pathology present in the special mastoid case.

If we base our treatment on clinical pathology we shall get better results.

DISCUSSION (*Abstract*)

Dr. J. W. Downey, Baltimore, Md.—A complete knowledge of the anatomy of the mastoid is most important, both in the diagnosis of mastoiditis and in mastoid surgery. We do not always get this from books on anatomy. You will all agree that we often find young children, even infants, with a rather fully developed mastoid, and even well developed tip-cells. Undoubtedly the anatomy has a great deal to do with the extension of the infection back into the mastoid, and explains why in many cases of acute suppurative otitis media we do not get a mastoiditis, and why some of our cases go on to an involvement of the mastoid in spite of everything we can do. Certainly in my experience the x-ray examination is of far more help in mapping out the cell structure and the size of the mastoid than it is in diagnosis.

Dr. S. P. Marks, Lexington, Ky.—Speaking of the sclerotic type of mastoid, in the past summer we operated upon a little girl three and a half years old for hard mastoid. The right side showed a very dense, sclerotic type of mastoid, so very dense that we thought she had a large abscess which involved the antrum and post-antral cells. But in getting in, the posterior part of the antrum below was involved, and what appeared to be a cyst which was nearly as large as the end of my thumb was found which had been under such pressure

that it had exposed the knee of the sinus, and the bone lying forward was as thin as tissue paper.

Dr. Townsend (closing).—Sometimes we find an infection in the mastoid that extends externally and perforates; at other times the infection becomes walled off and may stay so for a long time. At some later period in life the walled off area may become active and cause trouble, as may occur in the shaded spot in the lower picture of *Plate 5*.

Some areas of an infected mastoid may show healing of the bone, while other areas show progressive necrosis; that at least is one of the opinions advanced.

I have read much and widely in the preparation of this paper and ask pardon for omission of references.

CARBON DIOXIDE FOR THE RELIEF OF HICCOUGH*

By STEWART LEE JEFFREY, M.D.,
Coconut Grove, Fla.

A patient recently seen had developed paralysis of the bowel and a very severe pyelonephritis as postoperative complications. The condition was further complicated by the most severe attack of hiccough the author has ever seen, which persisted for a period of nine days.

All means for the relief of this symptom known to the author failed. Inhalations of carbon dioxide 30 per cent and oxygen 70 per cent were tried and found to relieve the symptom positively and immediately.

The gas mixture was administered in an ordinary gas oxygen apparatus, about one-half bag being used at a time. It was noted that coincident with the first deep inspiration produced the attack was relieved.

Relief was transient, and the procedure was repeated many times. The longest period of freedom from hiccough observed was five hours, the shortest period being about twenty minutes. This great variation is accounted for by the fact that during the nine days through which the attack persisted the patient became accustomed to the use of the gas and administered it to himself, resulting in great variation in dosage.

Subsequently the author has seen one other patient to whom he administered the gas mixture until a very definite sensation of smothering was experienced by the patient. The resulting relief from the hiccough lasted for ten hours; it then returned in so mild a form as not to require any further use of the gas.

Use of the gas mixture has been reported by two other physicians. Their experiences were exactly similar in all respects.

It is believed that this procedure has real value, that it affords a means for positive and immediate relief of the symptom, hiccough. It is further believed to be harmless to the patient.

It is not believed that this method has any effect on the underlying condition which causes the hiccough, with the possible exception of those cases where the symptom is due to a neurosis only. It is reported solely as a means of relief.

*Received for publication March 25, 1931.

SYMPOSIUM ON MALARIA

SOME SUGGESTIONS RELATIVE TO OUR MALARIA CONTROL ACTIVITIES*

By J. A. LEPRINCE,†
Memphis, Tenn.

Senior Surgeon H. R. Carter, United States Public Health Service, never told anyone of the part he took personally in the early campaigns against mosquito borne disease. He was content to confine his conversations to inducing others to become pioneer campaigners, but we can yet see and feel the influence of his unselfish attitude and activities. The people of the southern part of our own country as well as those in the republics to the south of us hardly yet realize the big part which he took in bringing about the elimination of the deadly yellow fever epidemics that raged through the Americas for centuries. He also watched and studied the pioneer efforts against malaria in Cuba and again at Panama, and decided that sufficient information was available for us to begin eliminating malaria fevers from our southland. Without any funds and without assistants he started anopheles control campaigns in Virginia and North Carolina in 1913. We all learned to know him well and to love him as well as to absorb his teachings that we later applied to practical advantage.

Likewise old malaria field workers here, and many of them without knowing of it, are most decidedly under obligations to the "Father of Mosquito Control," Dr. L. O. Howard, who is yet with us, for it was he who back in 1882 used coal oil as a means of destruction of mosquito larvae.

We all know Dr. Frederick Hoffman, who conceived the idea of originating our National Malaria Committee, brought it into existence thirteen years ago, and has taken an active part in its growth and progress.

Undoubtedly all countries which have serious malaria problems owe a debt of gratitude to these three pioneers, and your Chairman is decidedly convinced that most of you would like to see this debt paid. I wish to ask you how in your opinion this could best be done.

It would appear that we as an organization can best do our part by making the National Malaria Committee of more practical value to all malaria field workers throughout the western hemisphere by vitalizing our sub-committees and by making a greater effort to carry out some of the projected studies and activities suggested in Dr. Hoffman's "A Plan and A Plea."

Our constitution and by-laws should be so modified as to bring about this desirable change. Why should we allow ourselves to get into a rut?

A well-known professor of one of our leading universities recently made a statement to the effect that he did not see the advisability of directing a dead sub-committee, and that statement is worthy of serious consideration by each member of our organization.

We should feel much more cheerful about this if we were able to say at the close of the 1931 conference,

> "At last every sub-committee has made decided progress, and we have given something worthwhile to those that are to follow in our footsteps."

If we analyze our past efforts in a constructively critical manner we shall find a lack of courage in our method of attacking the apparently impossible problems that face us.

We shall also find there has been a tendency to repeat investigations, while a large number of important problems are yet to be solved, and should be investigated and solved so we may have the answers to problems that every field worker and many county health officers are decidedly anxious to obtain.

One reason for the above is that our annual programs have been too long and the business or executive sessions too miserably short, and it is high time a change was made so that our viewpoints may be broadened and our accomplishments more satisfactory.

During the past year or two some of the county health officers have done most important work of a practical investigational character, which should have been sponsored by this Committee. In my own State a county health officer with a very small fund has shown the same audacity and courage that was characteristic of Dr. Gorgas, and the results are wonderful.

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*Chairman's Address, National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Twenty-Fourth Annual Meeting, Louisville, Kentucky, November 11-14, 1930.

†Senior Sanitary Engineer, U. S. Public Health Service.

The fact that we are about to face a year of reduced local appropriations should not decrease the total amount of anti-malaria activities that can be accomplished by county health units and state health departments in the five hundred counties that have malaria problems.

In a half-dozen counties considerable permanent work has been accomplished where the county health officer obtained temporary use of the labor of the county prisoners. One county recently installed 13,000 concrete slab sanitary privies made largely by prison labor, while another county used fifty county prisoners to install eighteen miles of ditches. While this work was going on there were a number of county seats which were surrounded by prolific sources of *Anopheles quadrimaculatus* within Anopheles flight range of the office of the county health unit and of the county jail. Where we allow such conditions to exist can we say we have a well-balanced program?

It is encouraging to note that decided progress is being made in Louisiana, Mississippi and in Tennessee and Georgia in relation to county-wide malaria control.

With regard to screening of farm tenant homes, even though financial conditions may affect progress, it is and will be possible to improve the mosquito proofing of thousands of rural homes that are now screened but not Anopheles-proof.

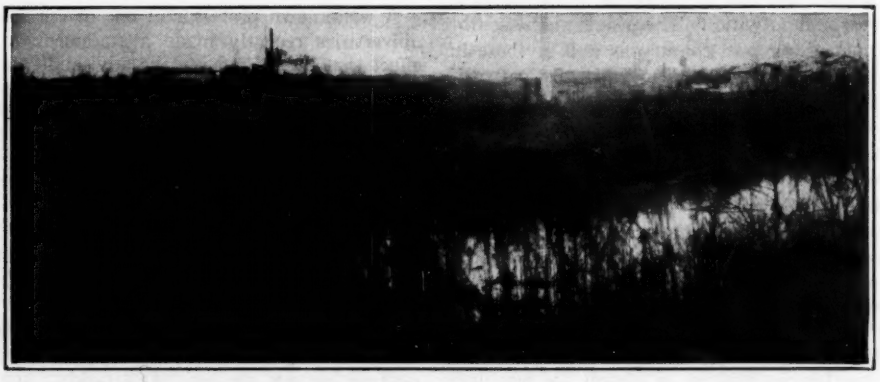

Fig. 1

Close to the court house of this county seat where the full-time health unit is located are prolific sources of anopheles. The anopheles propagation area shown is ten feet above river water level and only two hundred feet away.

Fig. 2

The outlet ditch of the anopheles breeding place shown in the picture has been clogged up for the past five years. Why? Plenty of county prison labor was available to keep it in effective condition.

We have definite information that it is possible to make and install low-cost substantial screen doors that will last more than eight years, and as time goes on there will probably be a tendency to have the same built by contract, and to rely to a large extent on this means of malaria control in rural areas.

Unless proper precautions are taken it is quite possible that defective screen doors will be sold by recommendation of county health units with disastrous results.

After visiting a large number of county health units over a period of years I am firmly convinced that proper training, and effective stimulation of sanitary inspectors, is the most important item in our county malaria control activities, and if we pay more attention to this item we can double what we are now accomplishing in county-wide control work. This matter is not receiving the attention that it should have. As it is not possible to have the inspectors at our conferences, we should see to it that a copy of the annual proceedings of this Association is given to each county sanitary inspector of counties having a malaria problem.

As the effective screening of farm tenant homes can be of decided value in preventing transmission and bringing about reduction of typhoid, dysentery and summer sickness of small children, as was definitely proven at Panama, it is most important that county health officials and those supervising activities of rural sanitation give this matter the consideration it should have.

THE MECHANISM OF ACQUIRED IMMUNITY IN AVIAN MALARIA*

By WILLIAM H. TALIAFERRO, PHD.,
Chicago, Ill.

The nature, extent and even the possibility of acquired immunity in malaria of man are much discussed questions. I thought, therefore, that you might be interested in a study of a clear-cut case of acquired immunity in bird malaria. True, it is an immunity to superinfection and exists only as long as the initial infection persists, but to rule it out on that score necessitates ruling out such well-known cases as the immunity in tuberculosis. Of course, how far the results in the avian disease can be applied to the human infection cannot be definitely known until much more work is done on human malaria.

For several years, in collaboration with Dr. L. G. Taliaferro and Dr. Paul R. Cannon, I have been engaged in ascertaining the factors involved in the very effective immunity which birds develop against *Plasmodium cathemerium*. This parasite is very similar to *P. vivax* and *P. malariae*, but is transmitted in nature by certain culicine mosquitoes. In the bird the asexual cycle, as has been shown by L. G. Taliaferro (1925) and others, takes regularly 24 hours, with gametocytes in small numbers occurring more or less regularly throughout the infection. A typical infection observed in canaries, according to the Sergents (1918) and others, is characterized by an incubation period of several days, depending upon the number of parasites injected and the route of injection; an acute period, as shown by a rapid rise in the numbers of parasites until sometimes every other cell is parasitized; then, if the bird does not die, which occasionally happens, a crisis during which the majority of the parasites disappear even more rapidly than they accumulated; the developed infection of a week or more, when a few parasites may be found in the blood; and the latent infection of many months, and even years, during which parasites cannot be found unless a relapse due to a lowering of the bird's resistance occurs. The latent period is of unusual interest in our work, because it is the period after the bird has overcome the initial acute infection. One outstanding fact characteristic of this period is that the parasites, although they cannot be found, are still present in the bird and can be demonstrated by inoculating comparatively large quantities of blood from such birds into normal birds, as has been shown by Wasielewski (1901), Whitmore (1918), and others. In fact, Mazza (1924) found that parasites could be demonstrated in this way in a bird four years and two months after the original inoculation. Furthermore, Moldovan (1912) and Ed. Sergent and Beguet (1912) ascertained that birds were only immune to a second attack as long as the latent infection persisted, whereas, upon complete recovery, they could become reinfected. Recently, Kikuth and Tropp (1927) confirmed the fact that birds were refractory to superinfection for as long as 5 months subsequent to infection.

As the first step in analyzing the factors in this immunity to superinfection, we (W. H. and

*Read before National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Twenty-Fourth Annual Meeting, Louisville, Kentucky, November 11-14, 1930.

L. G. Taliaferro, 1929) attempted to study it more quantitatively by ascertaining the rapidity and extent to which birds during a latent malarial infection can rid themselves of parasites injected directly into their blood stream in massive numbers as compared with normal birds. The outstanding advantage of such a study over previous work is due to the fact that so many parasites can be introduced intravenously that they can be found immediately after injection and observed thereafter.

For this part of the work 81 immune birds and 16 normal birds were studied after the intravenous injection of parasites. The immune birds were obtained by injecting parasites intraperitoneally, and making, staining and examining blood smears to insure that infection had taken place. Then at some time during the latent period, when it was found that there were no longer parasites present in approximately 10,000 red blood cells, the birds were injected intravenously with heavily parasitized cells. Within a few minutes and for a week or more thereafter blood smears were made from which the numbers of parasites per 10,000 red blood cells were ascertained. The type of results encountered is clearly brought out in *Fig. 1.* The experimental bird, that is, the immune bird, on the forty-third day of its primary infection when there were no longer parasites in its blood, and a normal bird, were given similar intravenous doses of parasites at 1:00 p. m. so that a few minutes later there were 8 parasites per 10,000 red blood cells in their blood. The sequence of events in the two birds was strikingly different. Whereas in the experimental bird the parasites had disappeared by 10:00 a. m. the day after the intravenous injection and never reappeared (the bird died on the eighth day of the experiment), in the control bird they showed a typical course of infection. The results were even more dissimilar when larger doses of parasites were given, for the immune birds disposed of their parasites so that they could no longer be found

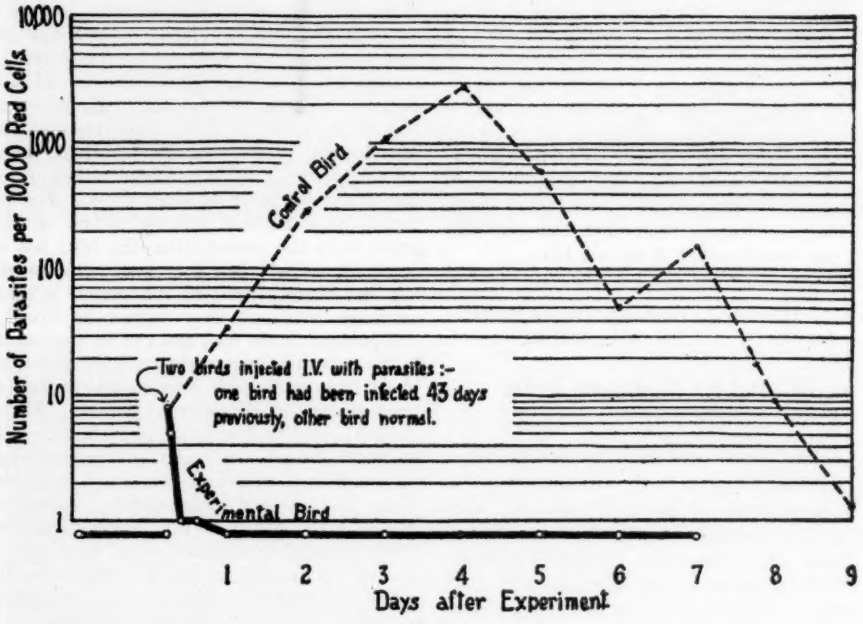

Fig. 1

Experiment Showing the Disappearance of Washed Parasitized Cells from the Blood of a Bird in the Latent Infection and the Survival of the Same Type of Cells in a Control Uninfected Bird.

Both birds (one with the latent infection and the other uninfected) were injected intravenously with enough washed infected cells so that a few minutes later both showed an infection of about 8 parasites per 10,000 red cells. In the bird with the latent infection these were removed from the circulation within twelve hours, but in the uninfected bird they survived and progressively increased in numbers, initiating a typical infection. (After Taliaferro, W. H. and L. G., 1929.)

2 to 3 days after injection, whereas the normal birds died between the fifth to the eighth day with approximately every other cell parasitized.

The data from these experiments may be briefly summarized as follows: there is a high degree of immunity to superinfection which begins as soon as the latent period sets in and lasts for extremely long periods. Thus, birds with latent infections that had been inoculated 16 to 656 days previously, when injected intravenously with large numbers of washed parasitized blood cells, disposed of them quickly, whereas normal birds could not cope with such enormous numbers and quite frequently succumbed. The removal of the parasites in the latent birds depends to a certain degree on the number injected. In other words, when approximately 1 to 100 parasites per 10,000 red blood cells were introduced, they were removed from the peripheral blood within 24 hours, whereas when from 100 to 400 per 10,000 red cells were introduced, they were removed within from 48 to 76 hours. The parasite-red-cell complex is removed throughout the asexual cycle and not simply the merozoites free in the serum, as is evidenced by the fact that when hourly blood smears were made following the intravenous injections the decrease in numbers was gradual and not restricted to the time of sporulation. The ability to remove the parasites is very labile and very delicately attuned to the physiological condition of the bird and may be upset upon the slightest provocation. Thus, of six birds with latent infections, when injected intravenously 33 days after the initial inoculation, 1 showed no parasites the following day, 2 got rid of them in 2 days, whereas the other 3 took 3 days to dispose of them.

In trying to find the basis for this high grade immunity we were helped by the work of L. G. Taliaferro (1925). She showed that whenever the parasites were found in the blood they were reproducing at the same rate. Therefore, the precipitous decrease in numbers of parasites at the time of the crisis and presumably the immunity itself is purely a parasiticidal mechanism and is not associated with any decrease in the rate of reproduction *per se*, such as occurs in some trypanosome infections (see W. H. Taliaferro, 1929). We felt that the most promising parasiticidal mechanism for which to search was some type of sensitizing antibody, either a lysin or an opsonin. Any such antibody generally would be easily demonstrated by testing the protective value of serum from immune, that is, latently infected, birds.

Very few investigations have been carried out on the protective or curative property of malarial serum. In human malaria, Sotiriades (1917) reported apparent beneficial results from the administration to a man with very evident symptoms of three 10 c. c. doses of serum from a malarial patient with no symptoms at intervals of four and one day, respectively. In a more extensive series, while working with induced malaria, Kauders (1927) reported beneficial effects and also presented evidence that immune serum is sometimes protective. In bird malaria, Moldovan (1912) did not find any protective property in immune serum when it was left in contact with parasites for 1 hour at 37° C.

The protective power of immune serum, which has been studied so extensively in trypanosome infections, is tested by injecting appropriate serum either simultaneously (or a day before or after) with the parasites in the same or different parts of the body of a suitable animal, or by injecting a mixture of serum and parasites after they have been in contact *in vitro* for lengths of time varying from a few minutes to several hours at room or incubator temperature. The curative power of immune serum is tested by injecting the serum just as the parasites are appearing in the blood. Accordingly, in our experiments, serum was injected protectively either intraperitoneally or intravenously and either simultaneously or after having been left in contact with the parasites for from 5 to 15 minutes at room temperature, or the day after the parasites had been injected: it was injected curatively either intravenously or intraperitoneally when there were between 1 and 10 (in a few cases 100) per 10,000 red cells.

Work on trypanosomes has established another fact. The present author and Johnson (1926) found that zones of effectiveness and non-effectiveness occur in the curative action of immune serum when a graded series of doses of serum is given to mice in which *Trypanosoma equinum* has just appeared. For example, doses of 0.3 c. c. and 1.1 c. c. of immune serum might cause lysis of the trypanosomes in the mouse, whereas an intermediate dose of 0.7 c. c. and even a larger dose of 2.1 c. c. might not cause any observable effect on the trypanosomes. Johnson (1929) in a further study found that the zone phenomenon depends on the number of parasites present at the time the serum is administered. In view of this work, various sized doses of

serum from birds with latent infections were given to rule out the possibility that the doses administered were insufficient or within the localized ranges of ineffectiveness. Such a series had to be accompanied by the injection of parasites into a similar number of normal birds which did not receive serum, because quite frequently a series of birds inoculated intraperitoneally as far as possible with the same amount of a homogeneous saline suspension of parasitized red cells shows a wide range of variation in the number of days before the parasites appear and some of them may not even become infected.

The sum total of all of the experiments on this phase of the work was negative (W. H. and L. G. Taliaferro, 1929). Immune serum from birds with latent malarial infections was not protective in four series when administered to 20 experimental birds receiving parasites and simultaneous doses of serum ranging from 0.02 to 2.0 c. c. per bird, as evidenced by the fact that parasites appeared in the blood of all but one of the treated birds within the same number of days as did parasites in birds receiving no serum. The one bird in which parasites did not appear exhibited a typical infection upon reinoculation, so that it seems reasonable to suppose that the initial infection did not appear, as occasionally happens in normal birds, but that the failure was in no way due to the dose of serum.

In trypanosome work it is well established that each contact of the trypanosomes with a parasiticidal antibody results in the acquisition of a temporarily inherited resistance to the antibody by the parasites, which enables them to reaccumulate (relapse) in the blood in the presence of the antibody (see Taliaferro, 1929). To obviate this difficulty experiments were carried out with a "passage strain," that is, with a strain kept in mice, where antibodies do not occur, or in rats, where it is transferred every fourth or fifth day before the antibody is formed so that the strain does not become altered. In a similar manner the parasites used for the protective experiments in the four series just cited might not be the same as those used to produce the immune serum, because between the inoculation of the birds furnishing the immune serum and the carrying out of the experiment, the parasites may have been subjected to a lysin and hence may have become antibody resistant. Therefore, four series of experiments were performed in which the birds that were to furnish the immune serum were injected with a passage strain, that is, the parasites were subinoculated from bird to bird before the number crisis had taken place. One series with such a strain seemed to indicate that the serum was thereby rendered protective since in 4 out of 7 birds no parasites ever appeared, but three subsequent series showed no such result: that is, the parasites all appeared as soon as did those in the control birds. Two of the series are particularly interesting since the three birds in each series received 4 daily doses of serum of 0.05, 0.1 and 0.3 c. c., respectively, beginning on the day the parasites were injected, but their parasites showed up just as promptly as did those in the control birds receiving parasites alone. Moreover, the immune serum itself was from birds which were hyperimmunized, since they had received an intravenous dose of parasites one month after their initial inoculation, namely, one week before being killed.

Nine series of experiments involving 36 birds indicated that immune serum is not curative when injected in varying doses from 0.02 to 2.00 c. c. per bird just as the parasites were appearing in their blood. The numbers of parasites in these birds showed no considerable decrease after the serum injections as compared with the numbers of parasites in 18 control birds receiving no serum.

Another experiment in which parasitized cells were kept in contact with immune serum for 6½ hours and then washed and injected in large numbers into a bird showed that the parasites had not become sensitized, since they increased in numbers just as rapidly as did parasites which had been in contact with the serum from the same bird from which the parasites had been collected.

With the failure to find any antibody basis for the immunity, Dr. P. R. Cannon and I* attempted to find a direct cellular basis for it. Many studies of the pathology of human and avian malaria have been carried out, but this is probably the first attempt to study systematically the histology at various intervals throughout primary infections, to compare this with the pathology of superinfection and to correlate these findings with the previous parasitological results.

The organs of most interest pathologically were found to be the spleen and liver. In normal birds the spleen was small (2x5 mm.) and its microscopic anatomy very similar to that of

*This work is to appear in the Journal of Preventive Medicine.

the mammalian spleen except that the trabecular tissue was scantier and the follicles less prominent. In general it was composed of lymphoid cells of various sizes and types which were arranged around the arteries and arterioles in sheaths. The lymphocytes nearest the arteries were merged imperceptibly into the typical macrophages of the pulp proper and showed frequent mitoses, but at no time did they approach the intense activation seen during the height of malaria infections. In the liver of the normal bird the Kupffer cells and the basophilic lymphoid cells were very inconspicuous. At the height of malaria infection, on the other hand, the Kupffer cells became swollen and increased in number and the various lymphoid cells exhibited many mitotic figures.

As a groundwork for the study of the cellular basis of the immunity during the latent infection, the pathology of 42 birds killed at various intervals during the course of infection was studied. For the earliest part of the infection birds were injected intravenously with enough parasitized cells so that the organisms could be found immediately after injection.

As early as 4 hours following a primary injection of parasites, an occasional parasite could be found in the macrophages of the spleen and liver, but there was no indication of an activation of the system. The constant phagocytosis of parasitized red cells continued throughout the acute period. This directly verifies the indirect findings of L. G. Taliaferro (1925) and Hartman (1927) on the great mortality of asexual forms during the primary infection.

Distinct evidences of activation of the mesenchyme appeared after 18 hours. Thus, in the spleen basophilic lymphoid cells were more abundant and mitotic figures more frequent; in the liver the Kupffer cells were moderately swollen. At the end of 24 hours the increase in numbers and activity of the macrophages was quite marked.

The activation apparently increased during the acute period until the eighth to tenth day, when it reached a climax concomitantly with the crisis of the infection. At this time in the liver the Kupffer cells were swollen and showed marked phagocytosis of malarial organisms, while the mononuclear cells, with numerous mitotic figures, had increased tremendously. The liver cords were also strikingly disoriented. In the spleen the activation was manifested by a diffuse hyperplasia of the lymphoid cells with many mitotic figures, a great increase of basophilic lymphoid cells and a larger proportion of pulp cells (macrophages) showing marked phagocytosis of malarial organisms.

Throughout our study we found phagocytosis of the parasites limited to the macrophages (the so-called hemophages of Kyes, Kupffer cells in the liver, pulp cells in the spleen, and so forth) of the spleen and liver and to a much less extent in other organs. Since there were very few macrophages found in the bone marrow, it seems highly probable, as some authors have suggested, that continued asexual reproduction may occur during latency in this site. Our histological study also indicated that the entire parasite-erythrocyte combination, rather than the isolated merozoite, is phagocytosed, which substantiates directly the indirect studies of Hartman (1927) and W. H. and L. G. Taliaferro (1929).

After the crisis a gradual decline in evidences of phagocytosis and activation ensued. This can undoubtedly be attributed to the fact that after the body has gained the upper hand very few parasites exist which need to be removed from the blood stream. One outstanding feature of the latent infection was that the pigment and debris which accumulated during the acute period and crisis largely disappeared within 30 to 40 days following the initial infection. This rapid disappearance of pigment allows the study of the pathology of the immunity to superinfection unhampered by the accumulated debris from the primary infection.

The altered reactivity (activation) of the mesenchyme which reached its height at the crisis persisted to a marked extent throughout latency. This is strikingly brought out by the fact that phagocytosis during superinfection (39 birds studied) was well initiated within 15 minutes after superinfection and functioned so successfully that within 24 to 48 hours parasites could no longer be found in the peripheral blood. The activation seemed to decline very slowly as tested by superinfection, but was still effective 654 days after the initial infection.

In view of the failure to detect parasiticidal antibodies and the direct observation of phagocytosis of the malaria parasites, we believe that the mechanism of immunity is primarily cellular and involves an activation of the mesenchyme. Our evidence, furthermore, indicates that the activation includes two factors: (a) an actual increase in the number of phagocytic cells and (b) a greatly increased rate of phagocytosis.

The picture might be considered more or less

complete were the activation of the mesenchyme non-specific, since then, of course, the absence of antibodies would be accounted for; but Gingrich (1930) has demonstrated that between *P. cathemerium* and *P. elongatum* the immunity is specific. Thus, during a latent infection with *P. cathemerium* there is an immunity to a superinfection to *P. cathemerium*, but not to *P. elongatum*, and vice versa. This demonstrates that the bird during latency acquires some mechanism which specifically causes its phagocytes to ingest the parasites and suggests some kind of opsonin which we have failed to demonstrate in our earlier experiments.

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DISCUSSION (*Abstract*)

Dr. H. E. Meleney, Nashville, Tenn.—Dr. Taliaferro has demonstrated conclusively that there is an opsonic or phagocytic antibody in the cells of the reticulo-endothelial system of the canary, produced by an initial malaria infection and persisting as long as a few parasites remain in the body. The presence of this antibody, like that of all antibodies, is demonstrated by its activity, which here consists of an increased reproductive activity and an increased phagocytic activity on the part of these cells. Dr. Gingrich's work seems to indicate that the antibody is at least species specific in bird malaria. It is probable that if the cells involved were free blood cells like the polymorphonuclear leucocytes, the phenomenon could be measured *in vitro* in the form of an opsonic index as is done in studies of certain bacterial infections. It might be that in malarial infections this could be done by using Bass' method of culturing malaria parasites and observing the intensity of the attraction of the large mononuclear cells for parasitized red blood cells.

The phenomenon described by Dr. Taliaferro can be seen in human malaria in autopsies on fatal cases, where the Kupffer cells and spleen macrophages are increased in number, show mitotic figures and contain many parasitized red blood cells. In the therapeutic use of malaria in general paresis, Dr. Bruetsch's work at the Central State Hospital, Indianapolis, suggests that much of the success of this measure depends upon the incidental effect on the treponema of the activation and multiplication of the macrophages in the perivascular tissue.

The occurrence of relapses in malaria in the presence of such an opsonic antibody would seem to indicate that there may be a second non-specific, humoral factor necessary to the activity of the specific antibody, or that this activity may be temporarily paralyzed by a loss of balance in the metabolism of the body. Another form of deprivation of the protective activity of the reticulo-endothelial cells is seen when the spleen is removed. In relapsing fever this is necessary in order to produce relapses in some animals and in Babesia infection it often brings out a latent infection.

One of the important characteristics of the specific antibody is that it is lost when the parasites are all eliminated from the body. This fact suggests that the opsonic activity of the cells, or rather their sensitization in preparation for phagocytic activity, is dependent upon the continuous presence in the body of a small amount of specific antigen. In this respect the whole phenomenon of immunity in bird malaria appears to be a state of allergy or temporary sensitization to the malaria parasite.

In clinical human malaria, I think there is one important phenomenon which is related to this problem, and that is the problem of repeated infections with the same species of parasite. There is considerable evidence that, in heavily endemic areas, persons who already have malaria become reinfected from year to year, suffer from clinical attacks, and gradually develop greatly enlarged spleens. One wonders whether this may be evidence that whatever immunity there may be in human malaria is specific for the strain of parasite within the species rather than for the species as a whole.

There is some clinical evidence that the opsonic anti-

body is not only species specific but strain specific. For instance, Nicole and Steele (*Jour. Trop. Med. Hyg.*, 24:48, 1926), stated that their paretics could not be reinfected with the same strain of benign tertian malaria with which they were first infected, but could be reinfected with another strain, either by mosquito bite or by blood inoculation. Strain specificity does occur in other infections in the formation of antibodies in the host. Trypanosome infection among the protozoa and relapsing fever among the closely related spirochete infections are examples of this. In relapsing fever both agglutination and lysis occur as evidences of this phenomenon. It seems possible that there may be a somewhat similar phenomenon in human malaria which would explain the clinical picture of superinfections.

In conclusion, I wish to pay tribute to the macrophage, the type cell of the reticulo-endothelial system. It is perhaps the most versatile cell of the body, and its importance in the protection of the body is constantly being more fully recognized. Dr. Taliaferro has contributed a valuable addition to our knowledge of the functions of this cell in malaria.

Dr. Walter L. Bruetsch, Indianapolis, Ind.—At the Central State Hospital, Indianapolis, we have had an opportunity to study the organs of general paretic patients who died during the malaria treatment. Histologic examination showed in the liver numerous histiocytic lining cells of the capillaries in the stage of transformation into free, highly phagocytic Kupffer cells. The changes in the human liver were similar to those observed by Dr. Taliaferro in the liver of birds. In addition we noted in the liver of our patients an activation of the undifferentiated mesenchymal cells leading to the formation of cellular accumulations in the periportal tissue. These periportal foci consisted morphologically of mature and immature basophilic round cells. Both cell types, the histiocyte or macrophage and the basophilic round cell have in recent years been identified with the production of natural immunity (Kyes, Epstein). From our studies we are inclined to believe that the beneficent effect of malaria in the treatment of general paresis depends mainly on the activation of the system of histiocytes, accompanied by a new formation of phagocytic tissue. The temperature seems to play a subordinate role.

Dr. Taliaferro (closing).—I think that certainly there is not any antagonism between humoral and cellular phases. The antibody is primarily in the cells and in some cases it goes into the blood stream.

I also agree thoroughly with the conception of nonspecific and specific factor. The increase in the number of cells must be specific and that is probably the same type of phagocytosis we get on infection.

There is a very close homology between Epstein's findings and ours. I think, in other words, this is just one of the phases of the general picture among reactions and not something specific to malaria. In human malaria if we can accept all the work that has been done, it does seem to be strain specificity, but in bird malaria only species specificity.

PLASMOCHIN IN MALARIA*

By Eugene R. Whitmore, M.D.,
Washington, D. C.

The history of malaria carries us back 2,350 years to the beginning of scientific medicine with Hippocrates, who distinguished intermittent from continuous fevers, recognized quotidian, tertian and quartan fevers, and noted their frequency in summer and autumn, and their occurrence near stagnant water.

Celsus, 1,900 years ago, distinguished two types of tertian malaria: a simple and a much graver form, the tertian and subtertian as we know them today.

We come down 1,600 years to the next important advance in our knowledge of malaria, the application of cinchona bark in the treatment of the disease; and we are now celebrating the tercentenary of that event. Quinine was isolated from cinchona in 1820.

We have just passed the fiftieth anniversary (on November 6) of one of the great events in medicine, the discovery of the malarial parasite. In 1897, MacCallum discovered the fertilization process in Hemoproteus and in the subtertian malarial parasite, thus explaining the meaning of the crescents and of the process of flagellation. In 1898 and 1899, Ross reported his results on the mosquito transmission of malaria.

Study during the intervening years has given us much information regarding the epidemiology of malaria, susceptibility and resistance, and many other points in connection with the disease.

Yet, with all this array of knowledge regarding the disease, malaria remains one of the outstanding scourges of the world, and one of the great problems in tropical and subtropical regions. Advances have been made on all sides; but our discussion today is concerned with the use of drugs in the control of malaria.

The treatment of malaria with cinchona, and later with quinine, is one of the outstanding examples and triumphs of chemotherapy; and I must say here what I have said repeatedly: that quinine properly given is the one outstanding drug in the treatment of malaria. Osler said

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that the physician who cannot treat malarial fever successfully with quinine should abandon the practice of medicine. But there are certain drawbacks and shortcomings in quinine which have led to attempts to use other drugs in conjunction with quinine, or, all too frequently, in place of it. These drugs have been discussed by Bass.

Of these drugs, plasmochin has received much attention since it was announced in 1926. Apparently one of the main ideas back of the preparation of plasmochin was to prepare quinine synthetically on account of the high price of quinine.

The early reports regarding plasmochin in malaria were enthusiastic in reporting that plasmochin alone in tertian and quartan malaria acts as well as does quinine, and that relapse is less frequent than when quinine alone is used. In subtertian malaria, Muhlens advised the combination of quinine with plasmochin, since quinine seems to have a better action on the schizonts, while plasmochin prevents the formation of gametocytes and destroys them when formed.

Cordes compared the action of plasmochin with that of quinine alone on the gametocytes in 72 successive cases of subtertian malaria, giving the odd numbered cases 2 grams of quinine sulphate daily in 2 doses, and the even numbered cases 1 gram of quinine sulphate and 80 mg. of plasmochin daily.

Of the 36 cases on quinine alone, 17 developed crescents during treatment: 4 were negative for crescents after 3, 4, 5 and 6 days, respectively, while 13 cases were still positive for crescents on the eighth day and later.

Of the 36 cases on quinine and plasmochin, 23 developed crescents during treatment: in 6 cases, crescents were found only once or twice, in 16 cases the crescents disappeared in 3 to 7 days, and in one case crescents were still present after 8 days of treatment.

While Cordes' short series does not confirm Muhlens' finding that plasmochin prevents the formation of gametocytes, it does demonstrate that plasmochin has a marked effect on the gametocytes, and that they disappeared from the peripheral blood in the majority of cases in 3 to 7 days. Gametocytes were still present in the peripheral blood in the majority of his quinine cases on the eighth day.

While various workers were studying the effects of plasmochin on crescents, as shown in stained smears of blood, Burke conceived the idea of studying the effects of the drug on crescents by experimentally testing its effect on the infectiousness of crescents for mosquitoes. Following out this idea, Barber, Komp and Naumann carried out a series of experiments in the Panama Division of the United Fruit Company. This work showed that small doses of plasmochin rendered crescents non-infectious for mosquitoes, even though the crescents were still alive and able to flagellate in the blood: in one case of an 11 year old boy, weighing 59 pounds, a single dose of 5 mg. of plasmochin rendered the gametocytes non-infectious for mosquitoes.

This rather startling finding called for confirmation in some other locality; and, at Deeks' request, Whitmore, Roberts and Jantzen repeated this work in Honduras.

These results confirm the work of Barber, Komp and Naumann to the extent that we never saw a mosquito infected after a single dose of 20 mg. of plasmochin to an adult; but 10 mg. of plasmochin was not enough to prevent infection of a small percentage of mosquitoes. The results on intermediate doses were not satisfactory, either on account of error in giving the dose or on account of failure to infect mosquitoes before plasmochin was given.

The variation in the infectiousness of the gametocytes for mosquitoes is interesting, and is discussed in our report.

DISCUSSION

In subtertian malaria, clinical experience has borne out Muhlens' early finding that quinine acts better on the schizonts than does plasmochin; and plasmochin alone is not used in the treatment of subtertian malaria.

Many workers are of the opinion that plasmochin combined with quinine hastens the cure of malaria, especially in chronic cases; but there is no experimental evidence on this point, and in the nature of things it will be difficult to obtain such evidence.

Cordes' parallel series confirms Muhlens' finding that plasmochin hastens the disappearance of crescents from the peripheral blood; but it does not indicate that plasmochin prevents the formation of crescents.

The experimental work in Panama and Honduras indicates that plasmochin has a marked effect in rendering the crescents non-infectious for mosquitoes, even though the crescents continue to circulate in the blood for 3 to 5 days. We made wet fixed smears from our cases in Honduras; and the study of the crescents in these preparations will be reported later.

How are we to explain this marked action of

such small doses of plasmochin? It is hardly possible that so small a dose of a drug would have so marked an effect in itself, especially when it has little effect on the schizonts. Of course, all of our cases were receiving quinine, as no one will try to treat subtertian malaria without quinine. I have no doubt that the malarial parasite is intracellular, as Whitmore showed for *P. relictum* in 1918, and as Ratcliffe showed for *P. vivax*. Is it possible that the plasmochin renders the red cells more permeable to the quinine, thus enabling it to come into contact with the contained parasite in greater concentration? Work on this point is now under way. Or does the plasmochin render the crescent itself more permeable or more susceptible to quinine in this less active vegetative state? If this were the case, it might be the explanation of the clinical experience that plasmochin aids quinine in clearing up obstinate and chronic cases of subtertian malaria. This brings up the question of adjuvants, which cannot be discussed here.

It has been suggested that plasmochin may aid in preventing relapse, possibly through its action on the gametocytes. Ross, Bignami, Thomson, and others opposed Grassi and Schaudinn's parthenogenesis or reversion theory of relapse, and held that the continuation of the asexual cycle was necessary for latent malaria and relapse. In 1918, Whitmore pointed out that the persistence of the asexual cycle was necessary to the persistence of gametocytes for longer than two months (owing to the short life of the red cell); and, in bird malaria, found schizonts to be present in the blood of infected canaries throughout life, thus making it unnecessary for the gametocytes to take any part in relapse. Simons (1919) found only schizonts, in all stages of schizogony, in 95.92 per cent of all of his cases of latent malaria in which he could find parasites at all. Ziemann and Simon saw gametocytes and schizonts in spleen puncture material, with no evidence of parthenogenesis or reversion of gametocytes to schizonts. Ziemann, in searching for parthenogenesis, found only examples that could just as readily be interpreted as infections of a red cell with schizonts and gametocytes, or as abnormal sporulation; and Schuffner (1928) comes to the conclusion that the appearances of parthenogenesis are multiple infections of red cells.

The frequent finding of sporulating forms in the spleen and liver of persons dead of some other disease than malaria; the finding of sporulators in placental blood of women who do not have malaria at the time of delivery; the not infrequent transmission of malaria by blood transfusion from a donor who has lived in a malarious country, but may not have had malaria, coupled with Thayer's failure to transmit malaria by injection of blood known to contain crescents, but which as far as could be determined did not contain schizonts: all of this speaks for a continued schizogony which is back of relapse, and with which the gametocytes have nothing to do. The impossibility of transmitting Hemoproteus (where only gametocytes are in the peripheral blood) by injection of infected blood, speaks strongly against the gametocytes' being able to undergo any reversion to schizonts and starting the asexual cycle.

All of this means that the schizonts are responsible for latent malaria and relapse, and that the gametocytes have nothing to do with it.

But we have known from the beginning of the work with plasmochin that it does not act as well on the schizonts as does quinine; and it is accepted that quinine is the drug to use against the schizonts. This means that the action of plasmochin on the gametocytes has nothing to do with preventing relapse, and that quinine is the drug for preventing relapse: the use of the standard treatment of malaria for this purpose is perfectly sound. The only place that plasmochin can have here is as an aid to quinine in stopping the asexual cycle, as has been observed by a number of workers.

Plasmochin has been used in the treatment of blackwater fever, with the idea of avoiding the bad effect that quinine is reputed to have on the red cells in some cases of that condition. But we know that, when malarial parasites are found in blackwater fever, plasmochin will not have any effect on the schizonts; and the gametocytes, on which it has some action (possibly only in the presence of quinine), play no part in blackwater fever. So, it is difficult to see where plasmochin is indicated in blackwater fever. Work is under way on the use of other alkaloids of cinchona in this condition.

Plasmochin has been suggested for use in prophylaxis of malaria in place of quinine, probably on account of the association of quinine with hemoglobinuria. Very recently, I have been consulted regarding the advisability of using plasmochin in place of quinine for malaria prophylaxis by a person going on an extensive trip "in back of beyond" in the Orient.

After what has been said regarding the lack

of action on schizonts by plasmochin, it is evident that under no conditions should plasmochin be used in individual prophylaxis against malaria. Quinine is the only drug to be considered here.

What, then, is the place for plasmochin? All experimental work indicates that the place of plasmochin is in rendering gametocytes non-infectious for mosquitoes. With experimental work indicating that small doses of plasmochin very promptly render crescents non-infectious for mosquitoes (some of our feedings were as soon as 11 hours after the single dose of plasmochin) it does not seem necessary to give the drug in large doses in courses of several consecutive days. The sheet anchor in malaria is quinine: 30 grains daily until symptoms stop (2 to 3 days), then 15 grains daily to complete the week, then 10 grains daily for not less than two weeks. The patient is given 20 mg. of plasmochin a day or two before discharge from the hospital, and this dose is repeated every 3 or 4 days during the follow-up period. This is in general the method now in use in the United Fruit Company divisions.

SUMMARY

In spite of our long and varied knowledge of the various factors associated with malaria and its control, the disease is one of the greatest problems of tropical and subtropical countries.

Quinine is the one outstanding drug in the treatment and control of malaria; and difficulties in giving the drug in the dosage necessary for the cure of the case is the main difficulty in its satisfactory use today. Quinine is the only drug to be considered in prophylaxis, treatment and prevention of relapse in malaria, and this includes the stopping of the production of gametocytes.

Plasmochin may have some adjuvant action to quinine in the treatment of chronic and obstinate malaria; but experimental work shows the particular field of plasmochin to be as an adjuvant to quinine in rendering gametocytes non-infectious for mosquitoes, and in hastening the disappearance of gametocytes from the peripheral blood. This makes it possible to return patients to duty without waiting for their blood to be free of gametocytes, a matter of great importance in the control of malaria in industrial organizations.

Discussion follows paper of Dr. Meleney, page 423.

MOSQUITO-PROOFING AND TREATMENT IN THE CONTROL OF MALARIA ON A PLANTATION*

By HENRY E. MELENEY, M.D.,
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and
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Ripley, Tenn.

The purpose of this report is to record the results obtained to date in an attempt to control malaria on a plantation in West Tennessee. The plantation, which is known as the Henning Farm, is composed of fourteen square miles of Mississippi River bottom land in Lauderdale County. The crops are principally cotton and corn. The farm tenants all live within an area of two and a half square miles near the eastern border of the farm adjacent to the hilly portion of the County (*Map 1*). There are sixty houses besides that of the farm manager. Fifty-nine of the tenant houses are occupied, ten by white and forty-nine by colored families. The total population is 262, 46 white and 216 colored.

The houses have been classified as to their structural condition with reference to the amount of work necessary to make them mosquito-proof.† The system of classifying the houses is as follows:

Class 1 is a house that has

(a) Weatherboard or clapboard exterior,
(b) Satisfactory roof,
(c) Walls and ceilings of tongue and groove boards or plastered,
(d) All floors tongue and groove,
(e) Doors and window frames in good condition for screening.

Class 2 is a house that has not more than two of the above items defective.

Class 3 is a house that has more than two

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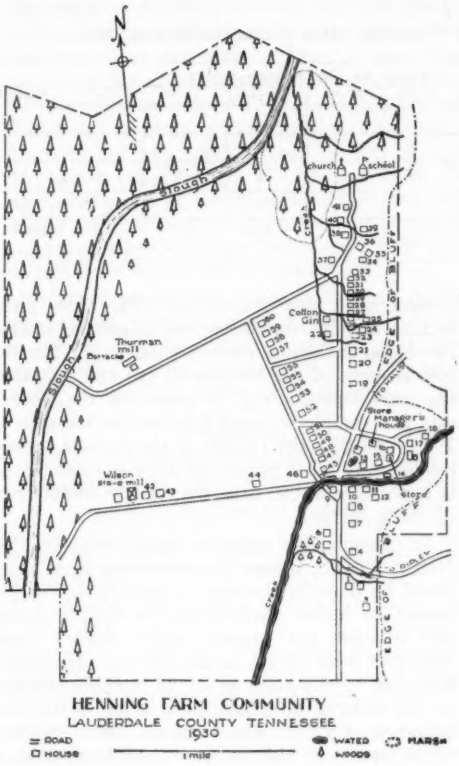
*From the Tennessee State Department of Public Health, the Department of Preventive Medicine and Public Health, Vanderbilt University, and the Lauderdale County Health Unit.

†This classification, as well as the rating schedule for mosquito-proofing which is to be described later, was devised in collaboration with Mr. H. R. Fullerton, Sanitary Engineer of the State Health Department, and he personally classified and rated the houses on the Henning Farm.



and not more than four of the above items defective.

Class 4 is a house where mosquito-proofing is not feasible.

According to this classification, four houses were placed in Class 1, thirteen in Class 2, forty-two in Class 3, and none in Class 4. This indicates that the structural condition of most of the houses is bad, but that it is physically possible to make them all mosquito-proof.

Since working conditions on the farm are good, there has been very little change in the population group since our study began in 1928. The farm contains many potential Anopheles breeding places, including a slough with adjacent marshy ground, a creek with numerous side pools, and several brooks which run down from the hills and some of which spread out into marshes or small ponds. In August, 1928, a survey[1] showed that 45 per cent of the inhabitants gave histories of chills during the preceding year and that 22 per cent had malaria parasites in the blood on a single thick-drop examination. Sixty-five per cent of the houses contained *A. quadrimaculatus* mosquitoes with an average of seven per positive house. The farm manager stated that the loss of time from malaria during previous cotton picking seasons had been a serious handicap.

MOSQUITO-PROOFING OF HOUSES

During the summer of 1928 the owners of the farm agreed to pay for the mosquito-proofing of the houses. Screen doors of the design recommended by the United States Public Health Service were made by the Lake County Health Department and screening was done under the supervision of the sanitary inspector of the Lauderdale County Health Unit. In the spring of 1929, the tenants were furnished with used cotton sample wrapping paper and by the end of the summer all of the houses had been fairly satisfactorily papered by the tenants themselves. During the same period, all floor cracks were covered with strips of sheet iron. It was found at this time that many of the screen doors already had been damaged.[2] The chief defect was a kicking-out of the screen at the bottom of the door. To remedy this, an additional four-inch wooden strip was inserted above the bottom member of the door. In the spring of 1930, baskets of mothballs were placed in all the chimneys and the unused stove flues were closed.

In October, 1930, a survey of the houses was made to determine their condition in regard to mosquito-proofing. Deductions for defects were made by means of a scale of rating somewhat similar to that used in the rating of dairies. Defects were recorded in screen doors and window screens, papering of rooms and closing of floor cracks. The maximum deductions for these items were as follows: doors 35 per cent, windows 25 per cent, papering 25 per cent, floors 10 per cent and chimneys and flues 5 per cent. The survey showed that the houses were about 92 per cent mosquito-proof. *Table 1* shows the rating of the houses according to percentage groups. This table shows that four of the houses were entirely mosquito-proof. Forty-two per cent were rated 95 or above, and 80 per cent were rated 90 or above. In analyzing the survey it was found that 40 of the houses had defects in the doors, most of which could be easily

Table I
MOSQUITO-PROOF RATING OF HOUSES ON THE HENNING FARM, OCTOBER, 1930

Class of House	Rating by Percentage Groups							
	100	95-99	90-94	85-89	80-84	75-79	70-74	Totals
1		4						4
2	3	5	3	1	1			13
3	1	12	19	5	1	3	1	42
Totals	4	21	22	6	2	3	1	59
Per cent of total	6.8	35.6	37.3	10.2	3.4	5.1	1.7	100.1

remedied, 10 had similar defects in windows, 42 had defects in papering and 14 had defects in floors. It is evident, therefore, that although nearly all of the houses had defects in mosquito-proofing, they were of minor importance. It is also evident that the screens are still in fair condition after a period of two years.

The degree to which mosquitoes are excluded from the houses even with this protection depends mainly on the manner in which the people use their screen doors. In a survey of the houses for *A. quadrimaculatus* on September 12, 1930, a total of fifteen mosquitoes were found distributed among ten houses. Although this is a marked contrast to the condition in August, 1928, when 35 houses were found to harbor 245 mosquitoes, the drought this year has so reduced the Anopheles breeding places that it is not possible to state how much of this reduction is due to mosquito-proofing.

TREATMENT OF MALARIA

Following the first survey of the farm in August, 1928, a course of treatment with quinine covering six weeks was administered to a large number of tenants. This was done by visiting the farm once a week and leaving with each family enough quinine to permit adults to take 15 grains on two successive days a week, and children proportionately smaller doses. As a result, the farm manager reported that practically no labor time was lost during the cotton picking season.

During the summer of 1929, quinine was again distributed to the tenants at intervals of two or three weeks and they were urged to take either ten grains a day or fifteen grains on two successive days each week. Again, practically no labor time was lost during the cotton picking season. A blood survey, however, made in November and December, 1929, showed 19 per cent positive, which was only 3 per cent lower than the per cent positive before the malaria control work was started in 1928. The three factors mainly responsible for failure to reduce the blood incidence were probably (1) the ineffectiveness of the treatment, (2) the fact that the mosquito-proofing of many of the houses was not completed until late in the summer of 1929, and (3) the failure of the tenants to use intelligently what protection they possessed. It is impossible to estimate the relative importance of these factors.

In planning the malaria control work on this farm for 1930, it was felt that very little more could be done in the way of mosquito-proofing except to install naphthalene in the chimneys and to close the unused stove flues. These measures were taken in the spring. It seemed desirable to eliminate as far as possible relapses of old malarial infections as a factor in the continuance of a high blood index. Since the previous treatment had not been well controlled, it was decided to conduct an intensive treatment campaign during the spring of 1930. A special nurse was employed to administer personally each dose of medicine. It was decided to use plasmochin and quinine together, since reports of other observers indicated that the course of treatment might thereby be shortened and that fewer relapses might be expected than with quinine alone.[3 4] The full course of treatment lasted five weeks and four days with an interval of one week at the end of the first three weeks. Quinine sulphate was administered in capsules daily throughout the treatment period. Adults were given 10 grains a day and children proportionately smaller doses. In addition, tablets of plain plasmochin* were administered on the first four days of each week, making a total of 24 doses given in six periods of four days each. Since we were anxious to avoid reactions to this drug, the dosage for the first two weeks was limited to 2 centigrams a day for adults and 1

*The plasmochin for this work was kindly supplied by the Winthrop Chemical Company of New York.

centigram to children between five and twelve years of age. Children under five years were not treated at this time. During the third, fourth, fifth and sixth weeks, 4 centigrams a day for the first four days of each week were administered to adults and proportionately smaller doses to children down to two years of age. The nurse administered 97 per cent of the scheduled doses of plasmochin and 95 per cent of the scheduled doses of quinine. No toxic reactions ascribable to plasmochin were noted, although they were carefully looked for.

A blood survey was made before treatment was started, another after the first three weeks of treatment, a third at the end of the treatment, and a fourth four and a half months later. *Table 2* shows the results of these surveys. The

Table II
BLOOD SURVEYS, HENNING FARM, 1930

	Total Specimens	Positive	
		Number	Per Cent
First survey April 1-5	230	31	13.5
Second survey May 5-7	236	12	5.1
Third Survey June 2-4	228	3	1.3
Fourth survey October 14-16	220	12	5.5

selection of persons to be treated was made after the first survey. In this survey, 25 per cent of the tenants gave a history of having had chills during 1929 and 13.5 per cent showed malaria parasites in the thick-drop preparations which were taken. Sixty persons were first selected for treatment. At the end of the first three weeks, treatment was suspended for one week in order to obtain the second blood survey. In this survey 12 persons, or 5.1 per cent, showed parasites in the blood. Ten persons refused further treatment, but 23 others were started, including nine who had first been positive on the second survey and fourteen others who requested treatment.

At the end of the second treatment period, the third blood survey revealed only three positives, an incidence of 1.3 per cent. One of these was a colored girl who had been given the full course of treatment because of a history of malaria. Her blood had been negative on both the first and second survey, but on the third survey a few small ring forms were found, the species of which was impossible to determine. The second positive was a colored boy whose blood had shown rings and crescents on the first survey. Although he received the full course of treatment, his blood showed a few rings on both the second and third survey. The third positive was a colored woman who had not been treated. Her blood had been negative on both previous surveys, but showed *P. vivax* on the third. No further attention was paid to the plantation until the week of October 14, when the fourth survey for the year was made. Twelve persons (5.5 per cent) were found to have parasites in their blood.

Table 3 gives a summary of the results in those who were treated. A satisfactory immediate result was, of course, to be expected even if quinine had been used alone. However, a point of interest which might be attributed to the aid of plasmochin is that eight persons showed crescents on the first survey, but none showed crescents on either the second or third survey.

The fourth survey showed that, among those who had been treated in the spring campaign, 11 (13.3 per cent) had had symptoms which might have been due to malaria since the treat-

Table III
RESULTS OF PLASMOCHIN-QUININE TREATMENT, HENNING FARM, 1930

Treatment Taken	Number Treated	Results of Blood Examinations										
		First Survey April 1-5			Second Survey May 5-7		Third Survey June 2-4			Fourth Survey October 14-16		
		Positive	Negative	Not Exam.	Positive	Negative	Positive	Negative	Not Exam.	Positive	Negative	Not Exam.
First Course only	10	5	5	0	0	10	0	9	1*	5	4	1
Second Course only	23	0	20	3	9	14	0	23	0	1	19	3
Both Courses	50	25	25	0	3	47	2	47	1**	1	45	4
Total	83	30	50	3	12	71	2	79	2	7	68	8

*This case was negative on both the first and second survey.

**This case showed rings (species undetermined) on both the first and second survey, but refused examination on the third.

ment campaign and 7 (8.4 per cent) had parasites in the blood. *Table 3* shows that, of the ten persons who had received only the first half of the course, five (50 per cent) were positive in this fourth survey, while of the twenty-three who had received only the second half, one (4.3 per cent) was positive. The first half of the treatment course had provided a little more quinine than the second, but had provided only two-thirds as much plasmochin as the second because of the smaller doses during the first two weeks. Although the series of cases is too small to warrant a definite conclusion, the results suggest that the first half of the treatment course was less effective than the second half, and that the higher dosage of plasmochin may have been responsible for this. In the last blood survey, no more than a few parasites were found in any specimen. Only two specimens showed parasites that could be identified as *P. vivax*, three showed crescents, one showed rings characteristic of *P. falciparum*, and the other six showed only a few rings, the species of which could not be determined. Our experience in other surveys makes us believe that most of these ring forms were probably *P. falciparum*. It appears, therefore, that this parasite was more difficult to eradicate from this group of people by the method employed than was *P. vivax*. The picture at the present time is that of an endemic malaria which might be termed residual in a group with a relatively high resistance to the infection.

As a control for the observations on this plantation we have the results of surveys made in March and September, 1930, in the Richwood school in the bottom land of Dyer County, where no malaria control work was done, and in the rural schools of Lake County, which is all bottom land. *Table 4* shows a comparison of these results with the results of the pretreatment survey in April and the last survey in October on the Henning Farm. Although the dates of the fall surveys are not exactly contemporary, we believe that they are close enough for comparison. It will be seen that the fall survey on the Henning Farm showed a decrease of about 60 per cent in the blood index, while those in the Richwood school and the Lake County schools showed no significant change. The summer drought of 1930 was probably responsible for the absence of the usual autumn increase in the index in the unprotected communities (Richwood and Lake County), and may have accentuated the decrease on the Henning Farm. But it did not produce a significant decrease in the unprotected communities like that seen on the Henning Farm. We believe, therefore, that we are justified in assuming that the decrease on the Henning Farm was due mainly to the treatment campaign.

Table IV

COMPARISON OF SPRING AND FALL BLOOD SURVEYS ON THE HENNING FARM WITH THOSE IN RICHWOOD SCHOOL IN DYER COUNTY AND IN THE SCHOOLS OF LAKE COUNTY

	Spring Survey		Fall Survey	
	Date Week of	Per Cent Positive	Date Week of	Per Cent Positive
Henning Farm	March 31	13.5	Oct. 13	5.5
Richwood School Dyer County	March 17	18.9	Aug. 25	17.2
Schools Lake County	March 17	11.5	Sept. 1	11.6

COMMENT

We realize that the type of treatment campaign used in this study could be employed only in small groups of people and under the most favorable conditions. Our results suggest, however, that in such groups the use of plasmochin in conjunction with quinine may produce better results than quinine alone. The method appears to be applicable where a rapid reduction in malaria is desired in conjunction with the employment of other malaria control measures.

The drought of 1930 undoubtedly contributed to the clarity of the result produced by the treatment campaign, since transmission of malaria was reduced, and fewer new infections were possible. It is probable that most, if not all, of the positives in the October survey represented relapse of old infections.

In measuring the effectiveness of mosquito-proofing, the drought was a hindrance rather than a help, since the finding of only a few *A. quadrimaculatus* in the houses in September may have been due mainly to their general scarcity. This is indicated by the fact that in the Richwood community in Dyer County, where there were only a few screened houses, a survey early in September showed that only six houses out of thirty-two contained mosquitoes with no more than two in any one house.

It is planned to conduct a campaign of education on malaria on the Henning Farm during the coming winter and to keep the mosquito-proofing of the houses in as good condition as possible throughout the mosquito season of 1931. In the autumn another survey will be made for the purpose of obtaining further information as

to the efficacy of the measures used in preventing malarial infections.

SUMMARY

(1) An attempt to control malaria on a plantation in West Tennessee by mosquito-proofing the houses and by treatment with quinine and plasmochin is described.

(2) Although most of the houses are of poor construction, a survey at the end of two years' work indicates that the houses are about 92 per cent mosquito-proof.

(3) Insufficiently supervised treatment with quinine during 1928 and 1929 resulted in only a slight reduction of the blood index of malaria.

(4) A closely supervised treatment campaign in April and May, 1930, covering five weeks and four days and using quinine and plasmochin, produced an immediate reduction in the blood index from 13.5 per cent to 1.3 per cent. Four and a half months later (October, 1930) the blood index had again risen to 5.5 per cent. No individual in the last survey showed more than a few parasites in the blood and most of the positives showed *P. falciparum*.

(5) Both the immediate and late results of the treatment campaign suggest that plasmochin may have increased the effectiveness of the treatment, both in freeing the blood of gametocytes and in preventing relapses.

(6) Too short a time has elapsed to make it possible to judge as to the efficacy of the measures used in permanently controlling malaria on this plantation. The drought of 1930 probably contributed to the temporary reduction in the incidence of malaria throughout the entire western border of Tennessee.

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DISCUSSION (*Abstract*)

Papers of Dr. Whitmore and Dr. Meleney.

Dr. H. C. Clark, Panama City, Panama.—There is a growing tendency in some quarters to discard quinine for the new drug, plasmochin. This, in my opinion, is a very serious mistake. After all, the actual control of "gamete carriers" depends on the destruction of the asexual cycle and quinine is the best drug we have for that, even though it does fail in a certain proportion of the cases treated. Recent research work indicates that plasmochin is of value in devitalizing gametes and preventing mosquito infection. More extensive research must be done to measure the real value of this feature.

It is difficult to harmonize the malaria parasite index in a community with the mosquito index of infection. This is particularly true when one stops to consider the type of human carrier that is required for successful mosquito feeding experiments. I am following eight rural villages without medical or sanitary care in the basin of the Chagres River and we do monthly blood film surveys of about 1,000 people. About one-fourth of these are positive for malarial parasites, yet we find only three or four people among these positives who meet the requirements at the time for good cases on which to feed mosquitoes. One is led to believe that new malarial infections form but a small part of the community index and that most of the incidence is due to chronic cases and relapse. I have seen several men leave the tropics for non-malarial regions in the temperate zone to escape what they considered renewals of infection, who discovered after long stays in such places that their trouble was relapse rather than new infection. I have one friend who went to New York and did not leave the city for two years, yet he had four attacks (relapses) of malaria, notwithstanding the fact that he was on vigorous treatment during each attack. Such experiences are discouraging, yet we can feel assured that quinine is by far the best friend we have to check, if not eradicate, the asexual cycle. Plasmochin, as far as experience points at present, is simply reserve assistance in the control of "gamete carriers" in those cases where quinine fails to eradicate the asexual cycle. I have seen one case of estivo-autumnal malarial fever followed by an attack of blackwater fever in an individual who was using plasmochin as a prophylactic measure during a protracted stay in a community with a high malarial index. These drugs (quinine and plasmochin) are useful in suppressing malarial activity in rural regions where one desires to salvage "labor days" to forward the work of commercial organizations operating in large malarial areas, but the actual eradication of infections is difficult and the best preventive measure is to prevent the bites from infected mosquitoes. This means the proper use of mosquito-proofed houses in regions where it is financially impossible to control mosquito breeding. It is extremely difficult to educate the labor class in the proper care and use of screened quarters. However, in the course of a few years, even with the indifferent use of screened sleeping quarters by such labor units shows a pleasing drop in the incidence of malaria.

Dr. L. W. Hackett, Rome, Italy.—I can confirm Dr. Whitmore's results with two centigrams of quinine, but I do not share his enthusiasm for plasmochin. Our reliance for the prevention of relapse must be on quinine.

We saw interesting results in the screening of quarters in Belgium. The houses were very well screened and mosquito-proofed, and an inspector was engaged to go from room to room every morning killing all mosquitoes. There had been 230 cases of malaria there the year before, and that year, after screening, they had 8 cases.

Dr. J. N. Baker, Montgomery, Ala.—Screening is but one of the physical, practical methods to be employed in the protection of man against those diseases brought to him by an intermediary, such as the fly and mosquito and, to my mind, one of the greatest benefits accruing from a campaign of screening lies in its educational value. A host of earnest workers are today striving to unravel the mysteries of the cause of cancer. Does any one make so bold as to assert its secrets will not be unearthed and that we here present may not live to know its cause and, may we hope, its cure? May we not hope the same in regard to malaria? The practical worker needs to grasp and utilize every spark which falls from the anvil of science. I have the feeling that in plasmochin, science has given a something which does strengthen and complement quinine therapy. It no doubt is not the last word; but it is a trail struck in the right direction. Let us, then, as practical workers, until something better is offered, test and retest this agency in the crucible of clinical experience, until we either know its worth or its worthlessness. In Alabama we have been making some practical tests in the use of this drug in several malarious areas, and I am going to ask Dr. Gill, our epidemiologist, who has had supervision of this work, to tell you quite briefly of this work.

Dr. D. G. Gill, Montgomery, Ala.—Dr. Baker refers to a small experiment we have been carrying on this year in Alabama as to the effect of plasmochin on the incidence of malaria.

We have chosen two areas, each of approximately one thousand population. These areas have been divided and one-half of each used as a control. The experiment, in brief, consisted of a preliminary survey, including history and blood survey of the whole area. Then, beginning with the first of June and continuing until the first of November, the people in the experimental area were given one tablet of plasmochin compound once a week. No other control measures were adopted. Careful histories have been kept of all areas and a second blood survey has just been completed.

No conclusion can be drawn as yet, but the opinion of our field workers is that there has been less malaria in the demonstration areas than in the control areas. This work will, of necessity, need to be carried on over several years before we arrive at any conclusion.

Plasmochin should be given a thorough test and I feel that there are possibilities of its being an efficient weapon in malaria control.

Dr. Paul Eaton, Jacksonville, Fla.—I came away from Miami last year with the idea that if I went into a malarial district I should take quinine for myself and give the other fellow plasmochin; in other words, that the only value of plasmochin was in preventing the infection of mosquitoes. What I have heard today rather upsets me. Is it being found that plasmochin is of use to the individual as well as to the community? I wish somebody would set me right about this.

Dr. K. F. Maxcy, University, Va.—As I understand the present status of knowledge on the subject, plasmochin given in doses of one to two centigrams over a period of three to four days will hasten the disappearance of gametocytes from the blood. This disappearance will be permanent if at the same time the parasite is completely destroyed in the patient's body by the concurrent treatment with quinine and the action of the defense mechanism of the host. If, on the other hand, the parasites are still present in the body, it is only a question of time before a new crop of gametocytes makes its appearance in the peripheral blood. While, therefore, the use of plasmochin compound may reduce the number of gametocyte carriers, its effect is only partial and more or less temporary. It is possible that its use in the cooler climates of the United States where the period of transmission is relatively short may be much more effective than in tropical climates.

Dr. H. C. Clark, Panama City, Panama.—We are trying to emphasize control of the production of gametocytes. As long as sporulation goes on, new gametocytes are produced.

THE ROLE OF THE PHYSICIAN AND THE VALUE OF THE THICK FILM IN THE CONTROL OF MALARIA*

By WILLIAM KRAUSS, M.D.,
Bolivar, Tenn.

An attempt will be made in this article to "sell" the general practitioner on the thick film in the diagnosis of malaria for the sake of better diagnosis and malaria control.

Malaria is essentially a chronic disease. A few doses of quinine will always stop the fever. A subsequent fever may be a relapse, a reinfection or something else entirely. Random dosing because of a previous history of malaria will not get us anywhere. The treatment of estivo-autumnal malaria differs from that of benign tertian, especially as regards collateral and after-treatment. A few doses of plasmochin stop the infectivity of gametes, but the problem of cure remains. Quinine by itself does not cure malaria. Some persons get well with little or no treatment; others require much more and still others, for example, the superinfected exhausted soldiers in the late War, are well nigh incurable. Their natural defenses have broken down.

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Neither the patient nor the plasmodium becomes "quinine-fast."

These are matters for the judgment of the trained physician. We must understand the normal mechanism of defense, the pharmacology of quinine, the mode of absorption, routes and rate of elimination, storage and destruction in the body, and effect of cathartics.

Great quantities of quinine are consumed under the mistaken idea that almost any fever, chilly sensation or indisposition is due to malaria. As to the absolute need or advantage of a blood examination, I regret to say that there are still very many who will differ with me. There are old practitioners who have not acquired skill in making smears. These men still defend the "therapeutic test." But that is what we get in chiropractic and Christian Science, "the proof of the pudding." For years I have been convincing chronic quinine takers that they had no malarial infection.

On the other hand, a laboratory diagnosis by the health department means correct treatment by the physician, inspection, protection against spread, and follow-up service to prevent recurrence. With a live local lay or auxiliary health organization behind him, the physician can convince his patient that this is real economy. No such service comes wrapped up with a patent medicine, the dose of which is usually just enough to suppress symptoms.

It is urged that smear diagnosis misses too many positives and that reports are too tardy to be of service. This unreliability is the fault of the physician, the laboratory, or both, or due to the chance of missing a positive smear. Many persons now examining smears are not competent. Only well-trained, keen-eyed, conscientious microscopists can give satisfaction, but we have to reach perfection by degrees and the physician can help. The responsibility for the patient rests with the physician who must use his best judgment. He can take a chance on a negative smear in the spring-time, but not in the season of pernicious malaria. Even here he is not through with the laboratory if he has begun treatment. The first doses often flush parasites out.

The pyretogenic limit is variously given at from 20 to 50 plasmodia per cu. mm., one to 250,000 red cells. There is a chance for false positives as well as negatives due to bad laboratory work. The very small slender rings of the subtertian are easily overlooked if (a) the smear is bad; (b) if it is improperly stained; (c) if a "daylite" lamp is used. Monochromatic light misses fine rings in superimposed cells or obscures the chromatin, which is essential for correct diagnosis. A binocular microscope reduces eye-strain. A keen-eyed worker can cover 100,000 cells in 15 minutes; twenty minutes should be the least for an average. A thick-film worker can do the same work in five minutes. If smears are positive one should not miss more than 3 per cent.

Method.—Slides and point to be punctured must be cleaned, the former scrupulously, with pure methyl or ethyl alcohol. Use no denatured mixtures nor cambric nor hypodermic needles. If you drive a small Hagedorn needle into the stopper of the alcohol bottle you will always find it and get a better smear. A small crystal of sodium carbonate will prevent rust.

Make a puncture on the dorsum of the finger or the tip of the ear. Grease and sweat pressed out from the palmar surface spoil the smear. The blood must flow freely enough with the least pressure.

Press out and wipe off the first drop. Grasp the slide by the edges and, at a point ¾ inch from the proximal end, take off a drop ¼ inch in diameter and about half as thick when on the slide. Wipe off for a fresh drop and place this an inch from the first and a small drop near the end to use as a label. This is to be spread transversely. With the corner of another slide spread the other two to the size of a one-cent piece by describing centrifugal circles. Perfect evenness is not necessary (Schilling method).

Also take a regular thin smear. For index work one thick and one thin can go on the same slide. For individual smears this is not practical. The mistake usually made is to take too much blood and either pile it up or run it over the edge. The larger infected cells are often found at the edges and end of the smear. Laboratories usually give the technic for thins.

On cold or damp days warm the slide before smearing. Cushion the air-dried slides to prevent jarring. The thicks may peel off with rough handling.

The time for obtaining the smear is when you reach the patient. Directions to take before the chill are absurd, except for laboratory study.

Its time of appearance is problematical; the best time is after the chill, and the earlier the diagnosis the better. There may be time to wait for a laboratory report, in which case a laxative may be given in the interim. An initial dose of quinine (if properly indicated) may be provocative of a positive smear.

"What is the use of examining the blood after quinine has been given or when we cannot await a report?" one is asked.

"Because your patient is entitled to a diagnosis and the health department needs the information. This is the real reason for a free examination."

In the hospital we withhold quinine until the smear is positive unless the case is obviously pernicious. In private practice this is not always a safe plan.

What are the chances of a positive report?

Of 657 consecutive cases of clinical malaria which I have checked over, 54, or slightly less than 9 per cent, had negative smears throughout. Eighty-one per cent showed parasites on the first examination. Approximately half of these had taken quinine or chill tonic.

SUMMARY

The treatment of malaria is the function of the practicing physician. The examination of smears and sanitary control belong to the health department. The fostering of interest in malaria belongs to the whole community.

The advantages of the thick film and a technic for best obtaining malaria smears are presented.

Greater interest in proper diagnosis is urged.

References for the study of recent advances in the treatment of malaria are given.

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RECENT DEVELOPMENTS IN THE CONTROL OF MALARIA IN ITALY*

By L. W. HACKETT, M.D., DR.P.H.,
Rome, Italy

Malaria has always been, and still is, Italy's chief health problem. This is the barrier which prevents the free movement of dense northern agricultural populations towards the rich deltas and sparsely inhabited plains of Sardinia and the south. This it is which, until recently, has kept Rome itself from exploiting the well-watered and fertile "campagna" at its gates, compelling it to obtain its milk from Milan and its vegetables from Naples. In fact, the long history of the attempt to rid the Tiber delta of malaria, with its dismal failures and impressive victories, is full of lessons for the malariologist.

Organized warfare on malaria did not await the discoveries of Ross and Grassi. From the earliest times malaria has been associated by Romans and Italians with swamps and standing water, and therefore drainage has had a sanitary as well as an economic aim in every epoch. Large scale operations are associated with the names of emperors and popes; of local rulers during the Renaissance, and of kings and prime ministers of United Italy since the Risorgimento. So-called consortiums or associations of landowners for the financing and execution of drainage schemes (corresponding to our "drainage districts") have existed in the Po Valley since the Fourteenth Century; and over a hundred years ago the grand dukes of Tuscany initiated a colossal project which is still going forward and will require another twenty-five years to complete. All in all, the Italians have wrested and withheld more land from the domination of the waters than the Dutch. They have given a name, "bonification," to land reclamation which has both hygienic and agricultural objectives, a name now universally adopted.

The financing of such projects is made possible by the high value of well-drained agricultural land. The Government usually offers 75 per cent of the total cost of reclamation, giving a promise to pay in fifty annual installments, covered after the first decade by the taxes on

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*From the Malaria Experiment Station, Rome, maintained by the Rockefeller Foundation in collaboration with the Italian National Health Department.

increased production. Owners raise the remaining 25 per cent by mortgaging the land, the value of which will rise from $4.00 to $80.00 or even $200.00 an acre as the water is drained off.

You will note that the soundness of the financial operations depends on the pressure of the agricultural population on the land, leading to an immediate intensive cultivation of drained areas, and to a market for produce at prices which will pay interest on the capital investment. These conditions have so far been present in Italy. You will remember that a population of 43 millions subsists on an area about the size of California, only one-third of which is susceptible of intensive cultivation. The absence of these conditions prevents similar drainage and colonization activities in the United States, or renders them unprofitable.

If, however, we inquire what the effect has been upon malaria, we must admit that these projects have not been uniformly successful, and only slowly effectual at best. The most striking, successful and permanent form of bonification, as well as the soundest from the point of view of malaria control, is the filling of bottom land or coastal lagoons by sedimentation of the flood waters of rivers from the Appennines, the disintegrating central mountain chain of Italy: waters containing at times 16 per cent of suspended material by volume. Great units of 10,000 or more acres each are diked around to the desired level and the rivers turned into them at flood. When the great tank is filled the water is allowed to stand for 48 hours and then led off over a spillway to make room for a new charge. In a good rainy season with six or eight floods a deposit of silt more than a foot deep can be obtained over the whole surface, and in fifty to a hundred years the level of a vast area can be raised from a metre or so below sea level to a metre or so above, so that natural gravity drainage will eventually do away with the necessity for pumps. Such a process of "warping" or filling on a large scale by the sedimentation of natural waters is going on both in the Maremma, or coastal area of Tuscany, and near Ravenna, but the area is a relatively small one. Rivers from the Alps do not contain enough suspended water, and the Po Valley and delta depend on pumps for drainage.

On the lowlands, with their network of sluggish canals and ditches, it has taken from sixty to a hundred years for malaria to disappear as a rule, and in some important cases malaria has not even been affected, the land has not been occupied and the project has been a failure, economically, agriculturally and hygienically. The reason for this is twofold. On the one hand, in the northern areas where the relative absence of estivo-autumnal malaria allows immigration to begin and intensive agriculture to proceed on the newly drained and rich soil, the attention of *A. maculipennis* (the sole carrier) becomes gradually directed to the numerous and well stabled domestic animals which soon become an important factor of agricultural economy. The association of this anopheline with man virtually ceases (as happened in Tuscany years ago) and malaria automatically disappears. We then have the situation known as "Anophelism without malaria." On the other hand, on the Tiber delta, pumping lowers the water table to such a depth that in the long dry season intensive agriculture becomes impossible without irrigation, and pernicious malaria is an insuperable barrier to colonization in the presence of anophelines in great numbers. In either case, drainage has not eliminated the insect carrier of the disease.

There is a sound biological reason why drainage, as originally planned in the delta, should have failed to eradicate malaria. The insect responsible for the transmission of malaria in Italy, as well as in the rest of Europe, is *A. maculipennis*, a mosquito of the north temperate zone, which finds its optimum breeding places in the cold waters of England, Holland and Germany. Its range extends as far south as the Mediterranean Sea, but in these latitudes it is compelled to seek the coolest waters available, and hence in summer it breeds almost exclusively in the vegetation along quiet edges of flowing streams and canals, virtually disappearing from pools and shallow standing water. Hence to get water into motion by drainage is not a deterrent, but often an advantage to a mosquito with these breeding habits. In Grassi's phrase, we are merely converting an irregular marsh into a rectilinear one. It is clear also why malaria can be so intense in the islands and south of Italy, where marshes and swamps play an unimportant role. It is the rivers of Sardinia, Sicily and Calabria that are chiefly responsible.

It is quite the opposite with the North American *A. quadrimaculatus*. This is a warm water mosquito whose range centers in our Southern states and extends only as far north as it can find suitable breeding conditions. Naturally it seeks standing water well warmed by the sun and, except in the very hottest summers, avoids running water entirely. It is not, therefore, that

the lesson of Panama was ignored by the European sanitarians; the fact is the results were not directly applicable. Mosquito control through drainage has been constantly attempted in Italy, but with indifferent success.

To take the most conspicuous example, the Tiber delta, drained with pumps since 1889, remained highly malarious and 90 per cent uncultivated for more than thirty years thereafter. It was this situation which, in the main, led to the adoption of state quinine in 1902, at the instigation of Professor Angelo Celli, a great pioneering name in Italian malariology.

It is a mistake to suppose that state quinine was introduced in Italy to provide free treatment for malaria at the expense of the Government. Here, too, the financial burden was decentralized and the whole plan put on a practical basis by the simple scheme of making malaria not only a reportable but an occupational disease. The responsibility for the treatment of malaria cases was placed on the landowners. To prevent evasion of this duty, the state, through dispensaries in zones officially declared malarious, employed local physicians to treat agricultural labor, charging each landowner at the end of the year with his share of the total cost of the service, including medicine, and charging the budget of the town itself for treatment of other employes and the poor. The state manufactures its own quinine and sells it at a small profit, the proceeds being devoted to malaria control and to opening credits in favor of very poor communities to enable them to purchase quinine.

What has been the effect of state quinine on malaria incidence and severity during the twenty-eight years which followed the passage of this law? We may sum up the situation very briefly by saying that the effect on severity has been marked and incontrovertible. The death rate from malaria has rapidly descended, and cases of pernicious malaria are far less frequent now than before. The effect on incidence has been almost negligible. There has been no demonstrable quantitative diminution in malaria for many years past. There are the well-known minor fluctuations in malaria from year to year, and many mild years may occur in a string to encourage those who are continually striving to prevent malaria by treatment. But bad years due to favorable conditions for anopheline breeding over large areas regularly recur, as in 1924 and 1930, and restore malaria incidence to its long-term average in those places where entire reliance has been placed on quinine treatment or prophylaxis. Quinine may be depended upon to mitigate the severity of the malaria and cut short the series of acute paroxysms; it cannot prevent relapses or the transmission of the infection.

It has been increasingly evident to far-sighted Italians in recent years that considerably more attention must be paid to the anopheline mosquito if they are to secure a reasonably rapid and successful result from the malaria program. This has led to numerous surveys and field studies, which are always a prerequisite to action in the entomological field. Prof. Fermi became an enthusiastic protagonist of larva control as far back as 1912, and his experiments, followed by those of Grassi and Sella in the Tiber delta dating from 1917, aroused public interest and contributed greatly to our knowledge of malaria epidemiology and anopheline behavior. In 1925 the Public Health Department, aided by the Rockefeller Foundation, founded the Malaria Experiment Station in Rome with field branches all over malarious Italy. Out of such studies has grown the present well-organized and nation-wide program of anti-mosquito work.

Four additional anti-mosquito measures not previously applied in Italy, nor for that matter in Europe, have been adopted in recent years with considerable success.

(1) *Concrete Channels.*—The engineers (following the Panama practice) have been making small concrete channels in the flat bottoms of drainage canals where the minimum flow is naturally small or can be reduced by pumps to the capacity of the channels. These keep the water moving, are easily cleaned, and allow minnows to penetrate into every ramification of the system of ditches. Such channels, with the aid of electric pumps and the cooperation of gambusia, have been sufficient in themselves to eliminate anopheline breeding from the area surrounding Ostia in the Tiber delta and to abolish malaria. Irrigation water has also been put into concrete channels.

(2) *The Introduction of Gambusia.*—This introduction from the United States has led to unexpected results. In standing water and slowly moving canals or drainage ditches these little fish have accomplished an astounding multiplication. No one accustomed to the behavior of gambusia in America could imagine the density which they can achieve under favorable conditions in European waters. Standing waters become fairly clogged with them so that the peas-

ants complain that the cattle refuse to drink. From one lime sink in Istria about an acre in extent we took over four million gambusia for distribution purposes last year without apparently diminishing the number per unit of area. No horizontal vegetation, however thick, can protect anopheline larvae from the fish, large and small, which constantly patrol every square inch of water surface. In the area of about 8 square miles which we have had under observation for five years in Istria, the spleen index in a scattered rural population has gone down from 98 per cent in 1924 to about 10 per cent in 1930; acute epidemic malaria is reduced to sporadic cases, and a tuberculosis preventorium for Viennese children can now be operated throughout the year instead of being closed, as formerly, from June to October. There has been no case of malaria among the 300 children in the last two years. Nothing but gambusia distribution has been done in this area.

(3) *The Systematic Use of Larvicides About Centers of Population.*—There are many communities in which malaria is due to the river-breeding of anophelines, and where drainage is not applicable nor gambusia successful. Here Paris green has proved to be of the greatest value. The routine application of Paris green under these conditions year after year is defensible and economical for several reasons. The population is aggregated into compact villages, so that in southern Italy about 88 per cent, even of the small farmers, live under urban conditions and only 12 per cent are scattered. The farmers live in town and go back and forth to their work each day. Such units of population are ideal from the point of view of anti-larval measures. Also the long dry season coincides with the season of malaria transmission, and there is, therefore, no temporary water to handle as a general thing. And finally, labor is cheap, the material inexpensive, and the agricultural population already habituated to the idea of using poisonous sprays against insect enemies. The Malaria Experiment Station has proved over and over again, under all sorts of conditions, that in Italy mosquito breeding can be prevented for less money that it takes adequately to treat the acute malaria in the local population. Paris greening all unavoidable anopheline breeding places within 1½ miles of population centers is therefore standard practice now in Italy. It is being extended as rapidly as surveys can be made, maps drawn and personnel trained, to all malarious communities in Italy south of Rome. The financing of the work follows the same lines as that of quininization described above. Anopheline breeding has been made a nuisance under the law and landowners are held responsible for eliminating it within 1½ miles of inhabited centers, and in drainage districts. To prevent evasion of this obligation, the local authorities will see that it is carried out and the expense will be apportioned to the landowners according to the size of their holdings.

(4) *Screening of Houses.*—Of course mosquito proofing is not a new thing in Italy, but it was limited to certain kinds of government buildings, principally railway employes' dwellings, in malarious zones. As late as 1924 there was general disbelief in the possibility of extending its use to the common people and especially to agricultural labor, owing to the general poverty and the type of houses, often ancient structures dating from the Middle Ages. Nevertheless, what can be done under such adverse circumstances is shown by the results of the energetic action of the Government of Rome which, in 1928, made it obligatory upon all houseowners of the Roman Campagna to screen. In 1930 the Malaria Experiment Station, desiring to carry out some staining experiments on anophelines in relation to unscreened dwellings, was unable to find unscreened bedroms in any part of the Roman Campagna. Of course the screening had not always been properly done nor carefully maintained. But education in the use and repair of screens has been introduced in the schools, with mending the household screening as part of the home-work.

Perhaps the most important advance ever made in Italy in the war on malaria was the so-called "Law of Mussolini" passed in 1928, governing the constitution and procedure of "drainage districts." These are now obligatory throughout Italy, so that the reclamation of all fertile but uncultivated land must be begun within ten years. A special bureau of "bonification" has been set up in the Ministry of Agriculture to organize, finance and supervise these projects. To be approved by the Government and receive its conspicuous subsidies, the project must include not only drainage, but also the construction of model farmhouses, fences and roads; the provision of a good water supply and adequate sewage disposal, the screening of all houses and the elimination of anopheline breeding in the area; a system of irrigation in closed pipes and open concrete channels which will not

cause a malaria hazard; proper medical assistance and hospital facilities, and a monthly subsidy to each family moving into the area sufficient to maintain that family until, by agriculture, it shall become self-supporting. This is the magnificent program of a relatively poor country without any natural resources to speak of except its soil and climate. It is an attempt to improve the condition of health and standard of living of its most important population group, the tenant farmers.

There is only one thing to add to this hasty resume of Italian anti-malaria activities. That is, to mention the machinery which has finally and only recently been evolved to make the necessary preliminary surveys of malarious communities, to initiate and supervise activities, to prevent duplication and overlapping of effort, to coordinate the different agencies which have entered the field of malaria treatment and prevention, and to determine local cooperative programs in consonance with local resources and local conditions. This machinery is the Provincial Malaria Committee. Now an Italian province is a much larger unit than our county. It has, on the average, a population of 500,000 people. The Committee is composed of representatives of the:

Health Department (provincial medical officer)
Public Works Department (provincial engineer)
Department of Agriculture (local agent)
The Red Cross
The Association of Landowners
The Syndicate of Farmers
Private agencies engaged in malaria work

Thus Italy, which feels itself essentially an agricultural country, is coordinating all available powers and resources to make a united front against the disease which, more than any other, is the enemy of the farmer, restricting his movements, paralyzing his efforts and lowering his standard of living.

DISCUSSION (*Abstract*)

Mr. Nelson H. Rector, Cleveland, Miss.—The Italian differs in many respects from the American. He in most instances favors work of a permanent nature, even though it may require a much longer time for completion. It is no unusual thing to see buildings in Italy which have walls eight or more feet thick and which have withstood the attack of the elements for centuries. The Italian seldom works hurriedly, and is seldom worried if many years are required for the completion of a single project.

Dr. Hackett mentioned that the Italians have reclaimed several areas that lay below sea level. The quickest method for draining these areas would have been to pump the swamps dry. However, the Italians chose a method by the use of which it was possible to keep the unit cost per acre much lower. I inspected some of this work in 1926 and found out that they place a levee across the lower end of the area in question. The velocity of the streams coming down from the hills is checked by the levee, and year by year the silt is deposited in the swamp, until finally the area is high enough for cultivation. The area can then be drained without the use of pumps. I was told by the engineers in charge that it would probably require 50 years for the filling of the area that I inspected. I doubt that we Americans would have patience enough to wait for Nature to do this work, but would prefer to execute the work at once, even though the unit cost would be relatively high.

In the Yazoo-Mississippi Delta, the major drainage has been practically completed and the same holds true for Italy. As Dr. Hackett has just stated, a plan is under way to make their major drainage system as near 100 per cent as is practical. The Italians excel us on another point, namely: they maintain their canals reasonably well, while in this country many of the large canals are allowed to fill by the growth of willows and other vegetation in the bed of the ditch. These poorly maintained canals are often a favorable breeding place for mosquitoes.

I understand that the universities and technical schools in South Carolina are giving a course on "Malaria: Its Cause and Prevention," to the engineering students; and I see no reason why all of our schools and universities (particularly those in the Southern states) should not include such a course in their curriculum. It is indeed unfortunate that engineers coming out of our leading schools know nothing about malaria, and are apt to create conditions that will be extremely difficult to correct in future years.

Dr. Hackett also mentioned that the Italian engineers are laying a small concrete ditch in the bottom of the large canals; and I am of the opinion that we shall see many of our large canals lined with concrete in the near future. Mr. Fletcher, of Memphis, tells me that he is planning to grade several canals with concrete. This permanent work will develop much more rapidly in Italy than in this country, because the people of Italy live mostly in communities. Statistics show that 80 to 90 per cent of the population of Italy lives in cities or towns, while in America the population is dotted over large areas. Our major malaria problem is now in the rural areas, and it will be some time before it will be practical to line the canals in the rural areas with concrete. The cost would be prohibitive.

In Mississippi the towns are paying more attention each year to permanent work, and I believe the time will come when very little larvicidal work will be required in our urban areas. We are finding out that it is much better to build malaria out, that is, to rectify some defect in our drainage system each year, and to look forward to the time when few mosquito breeding areas will remain in the vicinity of our towns.

MOSQUITO CONTROL IN HAITI, WITH ESPECIAL REFERENCE TO THE USE OF PARIS GREEN*

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Port-au-Prince, Haiti.

Mosquitoes and their control are among the major problems of the Public Health Service of Haiti. While our chief concern is malaria, dengue and filiariasis cannot be ignored. The inauguration of an airplane service between New York and South American ports with a stop at Port-au-Prince also brings about the possibility of the introduction of yellow fever.

Salt marshes along the coast and alkali flats in the interior furnish ideal breeding places for *Aedes taeniorynchus* and *Aedes sollicitans*. In a large fertile plain north and east of Port-au-Prince existence at certain seasons of the year is almost intolerable because of these mosquitoes. The same thing is true of many other sections of the island.

The preferential breeding habits of the different species are not so distinctive here as in many other countries. Anophelines are found in great numbers in such places as rice fields. They are also found in irrigation ditches, roadside pools, hoof prints, wells, springs, and along the banks of rivers where algae have accumulated.

Aedes aegyptii, probably the most frequently found and widely distributed of all the species in Haiti, is primarily a container breeder, but also breeds in tree holes.

Culex quinquefasciatus has only one preference and that for dirty water. *Aedes mediovittatus* is an annoying biter indoors in the daytime. This mosquito breeds so far as is known only in tree holes.

Each of the ten public health districts of Haiti is in charge of either a naval medical officer or a Haitian physician commissioned in the Public Health Service of the Republic. In each of the districts an assistant public health officer is placed directly in charge of sanitation. His duties comprise the supervision of street cleaning, market inspections, drainage, filling, mosquito control, fly control and other sanitary activities.

Under his supervision the chief sanitary inspector directs the activities of the inspectors who have sanitary control of properties, markets, streets, and so forth. In the larger towns zoning is employed and the divisions so made that the entire town is inspected every eight days. A card is made out for each property on which the results of the inspection are recorded. Mosquito breeding areas outside of the residential sections and in the small towns are handled according to conditions peculiar to each.

The funds for sanitation are obtained either locally or from the central government. Each town allots 5 per cent of its budget for sanitation. Those from the latter source are allotted monthly and are in proportion to the needs of the district and the total amount available. In addition to these sources an indefinite but small amount is received from individuals who reimburse the Service for work done on private property.

Supplies for the districts are issued by the central government and are limited by the budgetary credits received for that purpose.

Despite drainage, filling, destruction of containers and other measures, larvicides are still required in large quantities.

The supply of oil has seldom been sufficient adequately to control all breeding areas. The experiments with Paris green and moist sand previously reported[1] were sufficiently encouraging to warrant their continuance. A few of them are given in detail:

(1) *October 28, 1929*, at Bailey's Beach, near Port-au-Prince, were two parallel ditch rows in an abandoned rice field, overgrown with grass and rushes.

There was heavy breeding of Aedes and Culex (75-250 larvae per dip), with a scattering of first stage Anopheles.

The area was 36 square feet.

One teaspoonful of Paris green and 99 teaspoonfuls of wet sand were applied. This experiment was designed quickly to test the toxicity of a new lot of Paris green and therefore an excessive amount was applied. Within an hour 50 per cent of the larvae were dead and only a few were normally active. At the end of four hours all were dead.

(2) *October 28, 1929*, at Bailey's Beach, near Port-au-Prince, there was an abandoned rice field, covered with grass.

Two to 7 Anopheles were found per dip with a scattering of Culex and Aedes. The area was 903 square feet.

One teaspoonful of Paris green and 99 teaspoonfuls of wet sand were applied at 11:10 a. m., slightly more than one-half pound per acre.

At 2:10 p. m. (3 hours) in the entire area there were

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found only 7 live Anopheles larvae and no live Aedes or Culex.

(3) *October 30, 1929,* a rice field near Bailey's Beach was densely covered with native grasses and rushes. The depth of the water was 1½ to 4 inches.

Anopheles albimanus averaged two per dip; *Aedes taeniorynchus and Aedes scapularis* 50 to 150 per dip.

The area was 360 square feet.

One-half teaspoonful of Paris green and 49 teaspoonfuls of wet sand were applied at 3:20 p. m., one-third pound per acre.

At 5:00 p. m. (1 hour and 40 minutes), 80 per cent of all larvae were dead; no live Anopheles were found. The following morning no live larvae could be demonstrated.

The areas treated on October 28 and 30 were checked on November 7, when no large anopheles larvae were discovered. Those found were from 12 to 30 hours old. Aedes were very scarce.

A rice field consists of a series of square or rectangular plots diked on four sides to hold water. After the rice is planted water is turned in from an irrigation ditch and the dike repaired so that the land is continuously inundated. After the rice is harvested no further attention is paid to the land until time for another planting.

With abundant water and sunlight algae flourish, affording perfect breeding conditions for *Anopheles albimanus*. Several species other than Anopheles also flourish in such places.

(4) *October 31, 1929.*—In Petit Goave several ponds in a marsh west of the city were treated with Paris green and moist sand mixed in the ratio of one part of Paris green to 99 parts of the sand. These ponds presented heavy breeding of *Anopheles* and *Aedes*. In one hour and forty minutes 90 per cent mortality had resulted and in three hours all larvae were dead. This was a demonstration for the assistant public health officer and the inspectors. On November 15, on another visit to Petit Goave, a ditch that had been treated the day before by the chief inspector was checked. This ditch is 700 feet long, 1½ feet wide, and the water in it averages 3½ inches in depth. One teaspoonful of Paris green and 99 teaspoonfuls of moist sand were used. The inspector reported heavy breeding before the application, but no larvae were found afterwards.

Prior to October 31 there had been a shortage of oil with the consequence that breeding was found all over Petit Goave and the surrounding marshes. The use of Paris green was begun on November 1, and on November 28 an inspection was made of the whole area. No larvae were found.

(5) *December 10, 1929.*—The Garde rifle range near Port-au-Prince was a tidal flat with open water varying in depth from two to ten inches, with heavy breeding of *Culex corniger*.

The area was 7,200 square feet.

One and one-half teaspoonfuls of Paris green with 150 teaspoonfuls of moist sand were applied at 3 p. m., less than one-fifth pound per acre.

Nineteen hours later the mortality was about 90 per cent.

Considerable information was gained from these experiments and demonstrations indicating the feasibility of mosquito control by this method. The simple field test for toxicity requiring a few minutes to do cleared up any doubt as to the lethal effect of this particular lot of Paris green. Some of the Paris green remains on the surface of the water long enough to kill the Anopheles. In fact, where there was continuous observation of a treated area it was noted that they began to die before the other species.

Amounts as small as one-fifth pound per acre appear to be sufficient, although with the smaller amounts killing is delayed. Under ordinary circumstances very rapid action does not offer any real advantage.

That the method offers no practical difficulties is shown by the case of Petit Goave. The inspector was able after one brief demonstration successfully to cover his whole territory.

Our experience in the above quoted instances and many others during the same period confirmed the original work of Griffitts done in 1926 and reported elsewhere.[2]

In January all districts not previously visited were given demonstrations in its use. Some of these are of interest.

(6) *January 9, 1930.*—Salt flat near Port-de-Paix contained open water without vegetation, but with much floating debris. The average depth was 4 inches. There was very heavy breeding of *Aedes taeniorynchus* (200-300 per dip). The area was 9,720 square feet.

Eight teaspoonfuls of Paris green with moist sand at ratio of 1 to 100 were applied (7 oz. per acre).

Within three hours 90 per cent mortality had resulted. Control pools near by showed the larvae active.

(7) *January 11, 1930.*—At Petite Anse, near Cape Haitian, there was a pond in the center of this little coastal village. The water was open along the edges with a heavy growth of chara-like alga in the center, and varied in depth from two inches to eighteen inches.

There was very heavy breeding of *Anopheles albimanus* (25 to 100 per dip) and fairly heavy breeding of *Culex nigripalpus*.

The area was 20,250 square feet.

It was treated at 10:00 a. m. with 5 teaspoonfuls of Paris green mixed with dry sand in the ratio of 1 to 100 (one-eighth pound per acre), and checked at 3:00 p. m. (5 hours). Dippings over the entire pond revealed two first stage Anopheles and no Culex.

On the same day at the rifle range near Petite Anse a pool of 250 square feet showing heavy breeding of *Aedes taeniorynchus* was treated with one-half teaspoonful of Paris green in moist sand. Six hours later only one live larva could be found in the pond. This pond had a dense growth of clump grass.

(8) *On February 6, 1930,* during the course of a mos-

quito survey at Cayes, Anopheles were found breeding along the edges of the Ravine du Sud. This stream when in flood erodes the banks, leaving irregularities which in dry weather collect algae and debris. In all of them breeding could be found. All such places within a mile of the city were treated with Paris green and moist sand. Check on the following day revealed no larvae.

Since its adoption on January 1, 1930, as the routine larvicide, Paris green has proven very satisfactory to the public health officers as evidenced by their monthly reports. Its cost is so small compared to oil that they are able to use it in unlimited quantities. It is much easier to transport than oil, and sand for diluting it can be found everywhere. Unless large areas are to be treated an inspector can easily carry a day's supply in his pocket, mixing a new batch as he needs it. Fine moist sand from any convenient source is used. Sieving through 18 mesh screen removes the trash and small rocks and gives a more even mixture. Thorough mixing of the two should be done.

If the sand is too wet it clumps and does not spread well, and on the other hand if it is too dry the Paris green does not stick to it. The unit of one teaspoonful of Paris green to 99 teaspoonfuls of sand is a convenient one, as this amount can be readily mixed in a dipper.

It has not been found practicable to teach its application on the basis of poundage per acre. The size of water deposits varies so much that there does not appear to be any way to have the inspectors visualize an acre. The inspectors are told to sprinkle it lightly and check the next day for results.

It has to be applied by hand, a procedure which the laborers and inspectors soon learn. The wind does not help in the distribution as in the dry mixtures, so that the entire area has to be covered thoroughly.

In areas where only *Anopheles* control is desired, a 5 per cent mixture in lime is employed. This mixture distributed with the aid of hand power dusters has proved very effective.

For the first eight months of 1929, oil for all the districts cost $5,815.95. During the same period in 1930, the following year, the cost of oil and Paris green was $3,426.32, a saving of 41 per cent. The reduction in expenditure for mosquito control is actually greater than the figures indicate, because a part of the oil is used in latrines for fly control. It is not practicable to separate the two, as one oiler in the course of his rounds may do both mosquito and fly control.

In the district of Port-au-Prince in 1929, 2,000 gallons of oil were used each month. Since the adoption of Paris green comparable results are obtained with 500 gallons of oil and twenty pounds of Paris green. In other words, it has been possible to substitute 20 pounds of Paris green for 1,500 gallons of oil. At the prevailing price of 20 cents per gallon for oil this means a monthly saving of $295.

Paris green does not affect pupae.

With its widespread use in pastures and other places to which animals have access none of the public health officers have noted any ill effects on animals.

SUMMARY

(1) Paris green mixed with moist sand in the ratio of 1 to 100 by volume is an effective larvicide for general use in Haiti.

(2) During the eight months in which it has been used the expenditure for larvicides has been 41 per cent less than for the same period in 1929, the previous year.

(3) It has been used in pastures and other places accessible to livestock without causing apparent harm to the animals.

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DISCUSSION (*Abstract*)

Dr. T. H. D. Griffitts, Albany, Ga.—This is a report of the practical application of Paris green on rather a large scale for the control of sub-surface feeding larvae; the destruction of the salt marsh type of mosquito. In the salt marshes of the Atlantic and Gulf states they breed generally in shallow water. It is rather rare to find extensive breeding areas in water over 18 inches deep; more generally it is a question of less than a foot. Paris green put out as Dr. Cook has described will kill not only Anopheles, but Aedes and Culex in such waters.

It is particularly pleasing to me to have a report of the practical results of general mosquito control at a low cost by this Paris green method.

Dr. Cook (closing).—We noticed that Anopheles died first. The breeding scale varies, 5 or 6 to 106 for Anopheles. You cannot set any fixed limit. We have used it in water up to 12 and 14 feet depth, and gotten good results.

POSSIBILITIES OF MOSQUITO-PROOFING ALL RURAL HOMES IN A COUNTY*

By J. P. Moon, M.D.,
Tiptonville, Tenn.

For the past three years the County Health Unit of Lake County, Tennessee, has been attempting to mosquito-proof all the rural homes in the County. It is hoped that a brief resume of the procedure employed, the problems involved, and the results accomplished may be helpful in indicating the possibilities of carrying out a similar project in other counties where there is a definite malaria problem.

Lake County, located in the northwest corner of the State, between the Mississippi River on the west and Reelfoot Lake and the Spillway on the east, consists entirely of Mississippi bottom land, most of which is subject to overflow. It is traversed by numerous sloughs, many of which contain water throughout the year. It also has many ponds, pools and marshes which furnish ideal breeding places for *Anopheles quadrimaculatus*.

Lake County has an area of about 156 square miles (100,000 acres). The population, according to the 1930 census, is 10,486, but it increases by about 2,000 during the summer and fall of each year, owing to the inflow of wage hands to work the cotton crop. The records of the county court clerk show that the ownership of land is distributed among 260 persons, as indicated in the following table:

No. Land Owners	Acres Owned	Per Cent of County
16	1000–5000	40
44	300–1000	30
200	1– 300	30
Total 260	100,000	100

The land is cultivated largely by tenants, crop shares and wage hands, resulting in a high percentage of turnover in population each year.

This system of land ownership has made it necessary to deal with four distinct classes of people: first, the landowners, many of whom live outside the county or State; second, the agents, persons responsible for renting the farms; third, the tenants, or renters, who occupy a farm for at least a year and sometimes many years; and fourth, the wage hands, who crowd the shacks when work is to be had, but may be gone tomorrow, taking part of the house with them. The small number of landowners is an advantage, in that the cooperation of relatively fewer people is necessary than in a county of many small landowners, but the cooperation of non-resident owners is not easy to secure, the cost of screening to individual owners is greater and the floating population makes maintenance of the screens in good condition a serious problem.

The number of rural homes in the County, according to a recent survey, is 1,846. A large percentage of these consists of one- and two-room shacks with "lean-to" kitchens. The walls and floors usually have many cracks and holes, ceilings are lacking, and the roofs often leak. The number of weather-boarded houses, with good ceilings and tongue-and-grooved floors, probably does not exceed 10 per cent of the total.

The Lake County Health Unit started operating in September, 1927. Malaria was considered to be a major health problem and the death rate from malaria was the highest in the State (68 per 100,000 for the years 1925-6-7). A malaria survey of a community in the area subject to overflow made in July, 1928, gave a history index of 69 per cent, a spleen index of 57 per cent, and a blood index of 40 per cent (Meleney, Bishop and Roberts, 1929). School surveys with the cooperation of the United States Public Health Service in the same year showed a positive blood incidence of 11.2 per cent in March and 13.7 per cent in September. The survey would probably have given a higher incidence had not quinine been widely distributed in schools during the summer.

ORGANIZATION OF CAMPAIGN

In April, 1928, several of the most influential landowners and members of the County Court were invited to a meeting at which the State Health Commissioner and other members of his department and Mr. J. A. LePrince, of the United States Public Health Service, discussed the need of formulating a malaria control program for the County. At this meeting the Lake County Anti-Malaria Association was organized and a committee of five of the larger landowners was appointed to cooperate with the Health Unit in conducting a campaign to mosquito-proof the rural homes of the County.

It was decided that the County Health Unit was to secure orders for screening from the landowners, manufacture the doors, screen the

*Read before National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Twenty-Fourth Annual Meeting, Louisville, Kentucky, November 11-14, 1930.

Fig 1

HOUSE SURVEY AND RECORD SHEET
LAKE COUNTY ANTI-MALARIA PROJECT

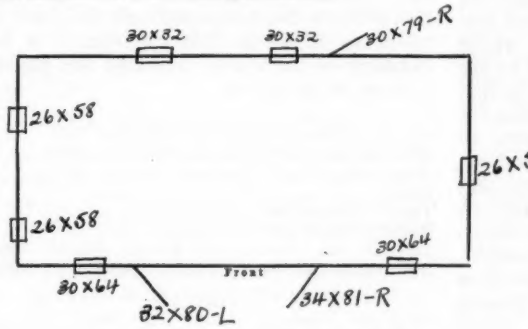
Dist. No. 3 Road No. 33 House No. 158
Owner A. E. Markham
Agent Harry Wade
Tenant Mehdon Wilson
House measured by J. N. Vandergriff Date 5-18-30

DOORS

Number of doors 3 Date made 5-26-30
Date doors left factory 5-29-30
Is Health Unit to hang doors, Yes ..... No X
Time hanging doors, hrs. 45 Min. Amount 15¢ Foreman's initials J.N.V.

WINDOWS

Number of windows 7 Total Sq. Ft. 71



Signed J. N. Vandergriff

homes, collect the bills and furnish this service at cost. A modern building was loaned by Col. A. E. Markham for the manufacture of doors, and the American Red Cross made immediate operation possible by furnishing the necessary equipment. The Anti-Malaria Committee provided a rotating fund of six hundred dollars and secured from hardware and lumber concerns a ninety-day credit allowance. This furnished a sum of about two thousand dollars with which to begin operations.

Record forms were devised, consisting of a work sheet and door tags (*Figs. 1* and *2*). These gave the location and ownership of the house, number, location and size of doors and windows, and other necessary information. The identification tag accompanies each door as it is assembled in the factory, shows on which side to apply hinges and its location on the house. Accounts were kept in a ledger, with details as to cost of doors, wire screen for windows and labor.

METHODS OF PROCEDURE

The first procedure was to obtain screening orders from the landowners. It was anticipated that this would be one of the most difficult problems, but it proved to be a minor problem. Most of the larger landowners in local residence readily consented to screen their houses. The screening of these houses at once created a demand on the part of the tenants for screening their houses, which brough in orders from many landowners in all parts of the County. As soon as orders were secured, a member of the County Health Unit took measurements for each door and window and the factory personnel proceeded to manufacture the doors.

The factory was constantly under the supervision of the County Sanitary Inspector or the County Health Officer. At first negro labor was employed, but this was found to be unsatisfactory, and later high school boys were employed with much better results. The boys were paid two dollars per day on the basis of their ability to complete ten doors per day, which insured a labor cost of twenty cents per door. During the summer an experienced carpenter was secured at the same wages to act as shop foreman and laborer as well.

Houses were screened as soon as the doors were completed. This was done under the supervision of the County Sanitary Inspector. The screen door was fastened to the frame by a hinge strip the length of the door and was cased in by 1-inch strips to prevent the ingress of mosquitoes about the edge. In many cases it

Fig 2

1928
OWNER Joe Moore
TENANT Bob Moss
Dist. No. 3 Road No. 21 House No. 181
Door Letter a Open R. X Open L.
FROM
LAKE COUNTY ANTI-MALARIA ASSOCIATION
Co-operating With
LAKE COUNTY HEALTH UNIT
Door Hung by Owner ..... Association X

was necessary to provide a new door sill as well. Windows were screened from top to bottom by sixteen mesh galvanized iron screen tacked on to the outside of the window frame with a two-inch lap.

Transportation of doors, screening and lumber to the houses was one of our difficulties for the first year and a half. Usually a wagon from the community would call for the doors belonging to a number of houses. Occasionally doors were shipped part way by freight. Because of the delay often occasioned by this haphazard means of transportation the State Health Department last year loaned the County a motor truck, which solved this problem.

Upon the completion of screening of a house or group of houses a bill was presented to the landowner. A few landowners who always had ready money paid promptly, but the great majority could pay only in the fall and winter when the cotton crop was in. This led to the rapid exhaustion of the available credit, so that at one time in 1928 the outstanding obligations amounted to $2,300.00. Collections were all made by the County Health Officer or the Sanitary Inspector, and occupied so much time that other work of the Unit had to be neglected. At the same time the filling of orders for the screening had to be suspended. Ultimately, however, practically all bills were collected or are now awaiting collection at the end of the present cotton-picking season.

INSIDE MOSQUITO-PROOFING

Complete mosquito-proofing usually requires, in addition to screening, papering the walls and ceilings, stopping holes and cracks in floors, closing flues and placing naphthalene in chimneys. Of these measures only the papering has been started in Lake County to date. This work began in the fall of 1928. Upon the recommendation of Dr. C. P. Coogle, of the U. S. Public Health Service, the heavy brown wrapping paper used for cotton samples was employed. The paper is of extra heavy, tough fiber 36 inches wide and of varying length. It was obtained from cotton factors and pickeries in Memphis and other near-by centers. At first the only cost of the paper was for transportation, but during the past year the demand has been so great that it has had to be purchased at a price of 70 cents per hundred pounds. It was transported to Lake County by freight or truck and was sold to landowners or tenants for a cent and a half per pound. Some landowners have purchased paper for their houses, but in many cases it has been purchased by tenants. The actual papering has been done entirely by tenants after a brief demonstration. This has reduced cost and has given the tenant an active interest in his own protection from mosquitoes. The paper is applied with tacks protected by card board discs and is overlapped in corners in such a way as to avoid any openings for mosquitoes. Papering is especially desired by the tenants because of the additional protection it gives them from the cold during the winter.

COSTS

Detailed data on the cost of screening in Lake County was reported by Fullerton (1929). Doors were sold during the first year for $1.50 each, but this was found to be too low a price to cover overhead expenses and the price was raised to $2.00 the following year. A brief summary of the cost of screening and papering a house is as follows:

	No.	Cost
Doors per house (average of 253 houses)	2.8	$ 5.60
Windows per house (average of 100)	4.75	
Average sq. ft. per window	12.5	2.06
Labor		.77
Paper (average per 3 rooms)		1.35
Tacks (average per 3 rooms)		.60
Total cost for average 3-room house		$10.38

RESULTS

The record of homes screened and papered up to November 1, 1930, is as follows:

Homes screened in 1927 (American Red Cross)	165
Homes screened in 1928 (County Health Dept.)	880
Homes screened in 1929 (County Health Dept.)	215
Homes screened in 1930 (County Health Dept.)	300
Total	1560
Homes papered to Nov. 1, 1930 (approx.)	500
Estimated cost of screening to landowners	$8500

The above statement indicated that 84.5 per cent of the rural homes of the County have now been screened. Although this accomplishment is the source of some satisfaction, I am fully aware of the fact that adequate protection from malaria will not be secured until all homes are entirely mosquito-proofed and until the people are properly instructed how to use and maintain the mosquito-proofing.

It is impossible at the present time to make any definite statement as to the effect of the screening so far accomplished on the incidence of malaria in Lake County. The results of the blood surveys in three communities and in the schools of the County for the past three years

Table 1

COMMUNITY SURVEYS FOR MALARIA
LAKE COUNTY, TENNESSEE

	Percentage of Positive Blood Specimens		
	1928	1929	1930
Cottonwood	40.0	32.8	15.8
Hathaway	18.0	9.8	4.3
Madie	15.0	9.7	10.5

Table 2

SCHOOL SURVEYS FOR MALARIA
LAKE COUNTY, TENNESSEE

	Percentage of Positive Blood Specimens		
	1928	1929	1930
Spring	11.2	5.5	8.8
Fall	13.7	16.1	10.5

are given in *Tables 1* and *2*. The communities showed a slight decrease in incidence in 1929 and a more marked reduction in 1930. The schools showed a slight increase in 1929.

Since 1930 has been a very dry year in contrast to the two preceding years, further comment on the results is not warranted at the present time.

MAINTENANCE AND EDUCATION

The problem of maintenance is properly the responsibility of the landowner, but many landowners do not reside in the County and others are woefully indifferent. Hence, because of the public health menace involved, the County Health Unit must concern itself with this problem. In spite of the eagerness on the part of tenants to have their shacks screened, we have found that in many cases, after several weeks or months, the screen doors and windows have been grossly abused. The installation of screen is to many tenants only a novelty, or at best a substitute for their former habit of smoking out the mosquitoes and closing the doors and windows to obtain a good night's sleep. Many of them, however, will not even maintain this advantage by taking good care of their screens.

There is no doubt that in education we have the keynote to solving one of our greatest difficulties in a screening program. The landowners must be shown that screening costs less than doctors' bills and food supplies for sick tenants for whom they are responsible. The tenants must be instructed on the cause and transmission of malaria and on the necessity of maintaining and properly using their screens. Our intensive educational program in Lake County began after the screening work had been in progress for more than two years. It should properly precede the screening work and run parallel with it. The educational program in Lake County has consisted of three main features. Talks on malaria accompanied by moving pictures have been given in the schools. Carter's "Malaria Primer" has been distributed in the schools to be read by teachers and children as part of their school work. Mosquito larvae in small hatching chambers have been placed in the schools to be observed as they emerge into adults. This program will be extended to reach more adult groups in the future.

In order to follow the degree of maintenance of screening and to determine its weak points, a survey of the entire County was made during the summer of 1930 by inspectors furnished by the State Health Department. In this survey each rural home was numbered by a permanent metal plate and was accurately located on a district map. The physical condition of the house and screens were recorded on a special form. The results of this survey have not yet been analyzed, but our intention is to use the data as a guide to future work and to observe the condition of the houses from year to year.

RECOMMENDATIONS

(1) I would recommend that an adequate rotating fund with which to carry on the work be provided (not less than one thousand dollars).

(2) Cooperation of resident citizens who will assume the responsibility of financing campaign.

(3) Dry lumber should be used in manufacturing doors and an additional strip 1x3 inches should be nailed at the bottom of door to prevent the wire from being kicked loose.

(4) Adequate transportation for screening material and doors.

(5) Competent shop foreman, constant supervision and inspection, with good labor.

(6) Educational campaign should precede and run parallel with the screening work. This, in my opinion, is most important.

(7) A better understanding or cooperation between landowners and tenants in the maintenance problem.

While I have emphasized consciously the difficulties involved in the program, yet it is only fair to state that our program was begun immediately following the devastating flood of 1927, and continued through another in 1929, which brought on the County the worst economic conditions in a number of years. I have no doubt that under conditions more nearly normal the work would have been easier.

"Can the methods used in the screening work in Lake County, Tennessee, be applied in mosquito-proofing the rural homes of other counties?" This question has frequently been asked. The answer, I believe, is in the affirmative. We have made mistakes by which others may profit and have accumulated information which others may use in beginning such a program.

REFERENCES

1. Meleney, H. E.; Bishop, E. L.; and Roberts, F. L.: Sou. Med. Jour., 22:382, 1929.
2. Fullerton, H. R.: Sou. Med. Jour., 22:395, 1929.

DISCUSSION (*Abstract*)

Dr. A. T. McCormack, Louisville, Ky.—This paper gives the complete answer to those who say that mosquito-proofing cannot be done. It requires a great deal more patience, more judgment, more pains than most men possess.

The most important part of a malaria program is the education and training of people who are going to be malaria-proofed so that they will know how to maintain the screens.

Once in the Canal Zone, in one house, I found two mosquitoes in a bathroom. I knew the regulations. I telephoned down to the sanitary inspector over the district. In a few minutes he came up in a truck with five negro laborers. In a short time they found where the mosquitoes were and called the inspector in and he dropped them into a test tube. He found they were not the kind that breeds in houses. He 'phoned the quartermaster's department and more men arrived in a truck and discovered a few openings through which these mosquitoes had come in. The sanitary inspector, knowing that these mosquitoes were not house bred, got a map of the district. He knew every quarter screened. They went over the district, inspecting each spot, and found where a leak had occurred in a pipe and there was a small pool. That was oiled and a guard placed to inspect every house in order to be sure that no other house had leaks in its screen wire where these mosquitoes could enter. It shows the necessary thoroughness of the work. Unfortunately, the lesson in Lake County is lost on most of us; it is like throwing a rock in a pond. The ripples are big in the center and get smaller as they near the edges.

The State Health Officer of Pennsylvania reported malaria in Pennsylvania; some malaria has been reported in Ohio and North Dakota. It is important to remember that in the treatment of paresis a lot of malaria inoculations have been made. Something is distributing the infection.

Mr. J. A. LePrince.—Dr. McCormack said malaria is spreading. You may be interested to know we have found cases in Utah contracted at elevations of 4,500 feet above sea level.

Dr. C. P. Coogle, Memphis, Tenn.—As late as 1927, there was still a large majority of the cotton planters in the Mississippi Valley who adhered to the then popular idea that the negro tenant houses could not be rendered mosquito-proof, and even if enough money were spent to render them mosquito-proof the negroes would not take care of the screens and the results would not justify the expenditure. This combination of opinions and fancies was passed from one to another as fact, and only after reasonably accurate observations and studies were made by men devoting their full time and energies to the problem have some of the true facts been discovered and proven.

The investigational studies conducted by the U. S. Public Health Service, together with the opportunity to demonstrate screening in these houses following the flood of 1927, undoubtedly won more converts for mosquito-proofing this type of home than any other known method could have in ten times the length of time.

In 1924, only 65 screen doors of this type were made and only 20 farm tenant homes in the malaria belt were known to have been mosquito-proofed. Today, six years later, we have records of over 70,000 screen doors of this type and approximately 20,000 rural tenant homes screened. This is pretty good proof that this type of screening and mosquito-proofing is being adopted generally over the malaria belt. The Bureau of Census lists approximately 1,622,000 farm tenant houses in the malaria belt of fifteen states, or an average per state of 108,133. Therefore, 20,000 is to 1,622,000, or 1/81 of the problem, or 1.25 per cent.

Malaria is not uniformly prevalent throughout the malaria belt of our country. We have good reason to believe that malaria foci vary in size and are irregularly spaced. However, it is our belief that even though malaria is not uniformly distributed over our land it is very essential that screening and mosquito-proofing be uniformly complete if we are to stamp out the disease.

It is a well established fact, based on a thorough piece of investigational screening work, that in a large area in the Mississippi Valley, where no screening or other anti-malaria activities were under way, malaria remained practically unchanged from year to year. Whereas, in a similar area where screening and mosquito-proofing were uniformly completed the disease is getting milder and gradually fading out of the area.

In a completely screened area one may expect the following:

(1) Fewer attacks of malaria.

(2) Shorter duration of the disease.

(3) A seemingly milder form of the disease.

(4) Fewer carriers to infect mosquitoes.

(5) Fewer chances the inhabitants have of being bitten by mosquitoes of any species; much better chance of escaping the bites of infected mosquitoes.

Mosquito-proofing to prevent malaria brings the inhabitants of mosquito-proofed houses additional dividends: first, dengue fever is a mosquito-borne disease; second, there are several fly-borne diseases and mosquito-proofing is in a great measure fly-proofing. Therefore, intestinal troubles, especially in babies and young children, and perhaps occasionally typhoid fever, are reduced in number.

There are many thousands of families living in unscreened homes today who never lived in a mosquito-proofed home. It seems to be a general consensus of opinion among malaria field workers that once one

can induce these people to mosquito-proof their homes the contrast registers and is firmly fixed in their minds and they usually thereafter think of screens as a necessity.

Screening is within the reach of everybody living in the malaria belt of the United States today if they will put forth sufficient effort to obtain it. The average income of the tenant class is approximately $1,000 per family per year. It would cost approximately $10, or 1 per cent of the income, to screen a house, with a yearly maintenance of approximately $1.00 per season, or 0.1 per cent.

It is, of course, possible for the cost to be slightly more than that mentioned, when installation and maintenance are included, particularly if a family is careless and permits children to mutilate the screens, thus requiring much replacement and repairs. The rich can buy screens if they want them. The middle class can buy screens. The average tenant class can buy or can obtain credit for screens. The indigent class can obtain screens through charity organizations if the proper appeal is made.

The possibilities of screening all rural homes in the malaria belt will soon become an actuality. It will be brought about by: first, education; second, demonstrations of effectiveness of screens; third, eternal vigilance on the part of the enlightened public, and particularly all public health workers.

The fundamental principles of mosquito-proofing in rural sections are applicable in any section, county or state in North America. Public health field workers must possess some ingenuity and create ways of shifting their material resources as well as formulate schemes successfully to use the materials at hand.

A public health worker, health educator, health instructor, or whatever one chooses to call him, rightfully and truly deserves a star in his crown when he has stamped out malaria in his given territory. It is evident that he has utilized both physical and mental resources in constant work.

To destroy all mosquito breeding places in the Mississippi Valley would be an enormous task, too expensive to be considered at this time. Urban mosquito control by destroying many of the breeding places and treating the remaining breeding places with oils or poison is thought to be feasible and practical and the results in disease reduction well worth the expenditure for the purpose. Many urban families and individuals visit in the malaria infested areas of rural sections and there receive malaria infections to return to their urban homes and come down with the disease. Urban mosquito control does not always mean urban malaria control. However, urban mosquito control offers protection to those individuals who remain in the mosquito free urban centers.

Screening and mosquito-proofing are just as applicable to rural homes as to urban homes and at this present day seem to be the key to the solution of the people's protection from mosquitoes that can be relied upon and is well within their means to do.

The reduction of mosquito breeding places in an effort to reduce the number of Anopheles mosquitoes is at this time thought to be too expensive and impractical for the reason that the physical conditions in the Mississippi Valley, which are extremely favorable to the propagation of these mosquitoes, will not be materially changed within the next fifty years.

Economists in agriculture and business have estimated that the point is about to be reached where reclamation of land for farm purposes under the present known methods is more expensive than lands of similar productiveness can be purchased for, and until the demand develops for more land the reclaiming of swamps and bayou beds by digging and maintaining great drainage ditches will very likely be indefinitely postponed.

By no manner of means is the majority of the breeding places used by the Anopheles mosquito confined to large swamps and bayous. Every artificial container that holds water, every depression, ditch and even wagon tracks and animal hoof prints may hold water sufficiently long to be a potential breeding place for Anopheles mosquitoes if not an actual breeding place.

Dr. E. L. Bishop, Nashville, Tenn.—From the point of view of the State Department of Health this work in Lake County is a study of the value of mosquito-proofing as a control measure. We do not feel that we have enough information as yet to know whether it is effective or not. I believe it will be a help. We will probably have to extend the work in Lake County into the problem of housing. There are certain classes of residences which it is almost impossible to render mosquito-proof because of bad construction or bad repair.

Dr. Moon has carried on a program of general county health work in addition to the malaria work, and that required a great deal of his time.

Dr. Moon (closing).—One cannot foresee the real difficulties in a county-wide screening campaign at the beginning. We were inclined to believe that securing orders for screening from the landowners would be our chief problem. This was not true. To our surprise, we found the landowner usually willing to cooperate. His chief concern was the care taken of the screening.

They did not object to buying screening once satisfied that the tenants would use it properly. Another thing I might mention is that in some few instances landowners were induced to screen these houses by creating a desire for protection from malaria on the part of these tenants. This will usually produce the desired results. Usually the screening of a community would create a desire on the part of other tenants for screening.

A definite estimate as to the effect of the screening so far accomplished on the incidence of malaria in Lake County was impossible. The blood surveys showed only a slight decrease in the past three years with a slight increase as shown on tables in some localities in the year 1929. While this is true it might be misleading. During the spring and fall of 1929 it was noted that while Lake County had only a slight increase in malaria incidence, the adjacent counties and states up and down the Valley had a decided increase, in some instances as high as 50 per cent.

RURAL MALARIA CONTROL: A COMPARISON OF METHODS*

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Washington, D. C.

The feasibility of rural malaria control having been demonstrated by more than one method, anti-malaria directors must weigh the advantages of each in a given area and make a choice of method. In sparsely settled districts those charged with the control of communicable diseases have been confronted with the question, "Can malaria be controlled at all?" Any suggested plan that seemed practicable and easy has been eagerly seized upon and has come into widespread use. If it did not produce the desired result its popularity slowly waned, as instanced by the rise and fall of the top-minnow.

Drainage which obliterates all breeding places is, of course, the best method. Regular application of a larvicide is the second choice, as it is, in the long run, more costly, requires more continuous effort, and allows a greater chance of failure through the occasional overlooking of breeding places. Lacking opportunity to engage in either of these methods, one must fall back on screening, which affords each individual an opportunity to protect himself, but at best does not insure automatic protection to every one, and is not everywhere applicable.

DRAINAGE

Major drainage has never had a fair chance in rural anti-malaria work. Inaugurated primarily for land reclamation purposes, no provision is made for residual drainage. Flat gradient ditches quickly "pot hole" and *quadrimaculatus* in abundance can usually be found over the entire area. In a tract of very soggy land in one of our Southern states there was no large expanse of open water; surface collections were small, very shallow, and all densely shaded by trees, bushes, or heavy grass. Quadrimaculatus was found only occasionally. Malaria was no problem in the farming population near by. After two years of extensive ditching for reclamation purposes the land was well dried, but long, broad canals of backwater crossed the area at half-mile intervals. To delay silting, the ditches had been cut with bottoms below grade. Vegetation lined the banks, quadrimaculatus abounded, malaria became a serious problem even outside the reclaimed area.

Even in the Mississippi Valley reclamation districts, where malaria control was emphasized and where the very slight fall in grade was conserved, most of the main ditches became ideal breeding places for quadrimaculatus. Maintenance looked toward agricultural reclamation rather than health conservation.

The greatest drawback of all is the practical necessity of forming a drainage district. Our laws are cumbersome and multitudinous. One company, desiring to eliminate opposition, purchased all the land to be included in a proposed drainage district. Nevertheless, eighteen months elapsed from the date of filing of the first petition before the district became a legal entity.

State health departments could very profitably study the drainage laws of their states. Most of these laws should be simplified and yet have added to them specific provision for anti-malaria work. It is significant that the preamble of many drainage laws contain the words "and for the promotion of the public health." This is usually the last time public health is either mentioned or conserved in the law. Most counties have the necessary legal authority to provide major outlets for road drainage. Armed with this authority, acting as a unit, a county may secure major drainage in spite of cumbersome laws.

A county containing a city or large town within its boundaries should consider major drainage as the method of choice. With the city's drainage as a nucleus, work could be gradually extended until the county became a drainage unit. The greater land values prevailing near the larger communities make the financing easier and the increased value of land which follows drainage renders it still easier to provide for maintenance.

LARVICIDE APPLICATION

In sections where people are clustered in small towns or villages, where the breeding places are numerous and small, and where the fall of the land is slight, major drainage becomes impracticable. The development of good roads and cheaper transportation tends to the abandonment of isolated homes and the consequent growth of villages. Community life, with its community interests, develops more social activity after dark, with the consequent increase of exposure to the bites of nocturnal mosquitoes.

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*Read before National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Twenty-Fourth Annual Meeting, Louisville, Kentucky, November 11-14, 1930.

†Surgeon, U. S. Public Health Service.

Larvicide application is the ideal method of malaria control in such an area. If Paris green is used the expense is reasonable.

As a basis for estimating probable costs one can use Griffitts'* figures of approximately $4.00 per acre of breeding surface dusted throughout the season of May to October. If breeding surfaces are rather extensive (even as high as four acres to the square mile) the cost would not be excessive to an average county. At the prevailing rate the season's expense would approximate six to eight thousand dollars, which is within the budget of the average county.

Concentration of population allows larvicide application in selected areas. Numerous breeding areas distant from habitation can be ignored. If areas which must be treated average approximately one acre per square mile the annual cost to the average sized county may be as low as $2,400.

SCREENING

In sections where land values are comparatively low, where *quadrimaculatus* producing areas are numerous and homes are scattered, screening offers the most practicable solution to the malaria problem. As the county is prevented from spending public money on individual homes, an adequate revolving fund must be raised. An energetic county health officer can then secure the screening of most of the homes in his territory. Where there are no large landowners to contract, individually, for the screening of a considerable number of tenant homes, much time must be spent surveying homes and persuading tenants to screen. As the cost of completely mosquito-proofing individual tenant homes has been brought so low, approximately $7.00 per home, abject poverty can be the only financial argument against a screening campaign. The cost of this method to the governing body can be as low as the salary and transportation of one man.

CHOICE OF METHOD

It is no longer good policy to pick a single method and insist that it be applied over a large area unless a careful survey has indicated that that will be the most effective. The size and population of every county can be determined from maps and census records, and the population concentration estimated by a quick motor trip over the main roads. This trip will also indicate which sections must be searched for breeding areas. It is not necessary to dip for larvae in all collections of water; anti-malaria workers of moderate experience, after examining a few examples of each type of breeding place, can estimate the producing acreage with negligible error. Detailed mapping of breeding places can be done after control work commences.

Occasionally all data necessary to a choice of method and estimate of cost is on record. A blood index completes the epidemiologist's information. Such brief topographic and demographic studies will eliminate an impracticable method. The cost under each remaining method should be estimated and the best plan chosen which the county can afford.

In Italy, an excellent land reclamation project, accompanied by complete anti-mosquito drainage, failed because the land produced nothing better than sorrell grass. In India, a larvicide campaign proved ineffective because the labor available was of such low mentality that breeding areas were constantly overlooked. One of our own screening campaigns was useless because the people slept in the street in hot weather. These incidents emphasize the necessity of making a comprehensive epidemiological study, of carefully weighing the evidence collected, and of suiting the method of control to the conditions found.

*Unpublished data.

DISCUSSION (*Abstract*)

Dr. T. H. D. Griffitts, U.S.P.H.S., Albany, Ga.—Dr. Bishop referred to the work in Tennessee as an experiment rather than a demonstration in malaria control. In one county in southwest Georgia where malaria has been quite prevalent we are conducting a study in the control of malaria in an area of 343 square miles. We are attempting to control malaria by the use of Paris green over the entire area. So far the cost has been $4.00 per acre of water surface.

I think while we may not ourselves be able to bring about such a change, it is an important question whether we are going to continue to attempt to control rural malaria in poor sections of the State where we have negro tenant farmers scattered over large areas, or whether some time in the near future we are going to try to change conditions of living, so as to get the now scattered population housed in communities where public health work may be feasible. It is something to think of, something to work towards, that we may possibly use some means to change our conditions in the rural South so that we can bring these people into communities and secure not only effective malaria control, but protect health in other ways. It is expensive, regardless of the measures, to do effective malaria control or general health protection with people scattered very thinly. I have attempted to get landowners in one county to hold a meeting for the purpose of considering it. I doubt whether one-half of the tenant houses in the county are worth $100.00 apiece. I think it would

be good if it were possible to re-establish these houses on the main highways in communities so it might be possible to control malaria. It is difficult to control malaria in a scattered population until we do finally bring about different housing conditions and get the people into communities. We know the negro likes to be in a crowd; likes community life. Although they may live a half mile apart, we know that they get together at night, and herein lies a difficulty in malaria control by screening.

METHODS AND APPROXIMATE COSTS OF MALARIAL PREVENTIVE MEASURES ON HIGH ROCK LAKE IN NORTH CAROLINA*

By D. CLARK,†
Badin, N. C.

The Tallassee Power Company's High Rock reservoir is located on the Yadkin River and lies principally in Rowan and Davidson Counties, North Carolina, the extreme upper end between the North and South Yadkin Rivers being in Davie County, North Carolina.

The general topography of the area immediately adjacent to the dam site is rough and hilly, the remainder is rolling to flat and the lake as a whole, especially in the upper river and creek sections, is very shallow. In the up river section of the reservoir, for a distance of about eight miles, the banks along the river channel are higher than the maximum elevation of the lake, while the bottom lands back of these banks are from one to six feet lower, consequently with a full lake these river banks form a continuous string of long narrow islands. The shore line of this lake is extremely irregular and has hundreds of long, narrow, shallow bights or bays, some of which extend back a thousand feet or more.

The adjacent area within one mile of this reservoir is thickly populated and occupied by a prosperous farming community; some of it is highly productive and it includes the towns of Salisbury, Spencer, Yadkin, Linwood, Lexington and Southmont, having a total population of about 35,000 people.

The State Board of Health, knowing that work on this development would start in the autumn of 1926, decided to make a malarial survey of the entire area of the reservoir and the adjacent territory within a distance of one mile of the proposed lake when at its maximum elevation. This survey was started in the summer of 1926 and continued until late fall of 1927. A complete malarial history was compiled of every inhabitant within this area, blood smears were taken and the spleens examined. Also all known and potential mosquito breeding places were frequently examined, catching stations established and the density of Anopheles production determined. This survey disclosed a large number of cases of malaria in this area; that the production of Anopheles was general over the entire basin, and in places was extremely heavy.

The lake is formed by a concrete dam sixty-five feet high across the Yadkin River at Stafford's Mountain just above High Rock, which impounds the water a distance of approximately twenty-five miles up the Yadkin and up some of the creeks for a distance of approximately sixteen miles. In addition to the area adjoining the river, the water is backed up six large creeks in Davidson County, namely: Flat Swamp, Abbotts, Crow, Swearing, North Potts and South Potts, and six large creeks in Rowan County, namely: Panther, Dutch Second, Grant, Crane, Deals and Second Creek. The total area below the flood line of the lake is approximately 16,000 acres, 10,000 acres of which was covered with a heavy forest growth which it was necessary to clear prior to impounding water. The distance around the shore line of the lake is 366 miles.

The construction of the dam and the clearing of the reservoir was started September 1, 1926, and continued until the entire basin was completely cleared and all unmarketable logs, brush and trash burned, which work was completed January 1, 1928.

Before impounding the water a force of competent men was organized to keep the lake in a wholesome condition and to control the production of mosquitoes. The large area of the lake and the long shore line made the question of transportation of great importance, and it was found advantageous to establish a permanent camp at an easily accessible, centrally located place, and to use boats for transportation. A site was selected just above the mouth of Crane Creek on the Rowan County side of the lake and a permanent camp established on a high, well wooded knoll, close to the lake, which at this point has a very steep and abrupt shore, which even when the lake is drawn down will permit a landing close to the camp.

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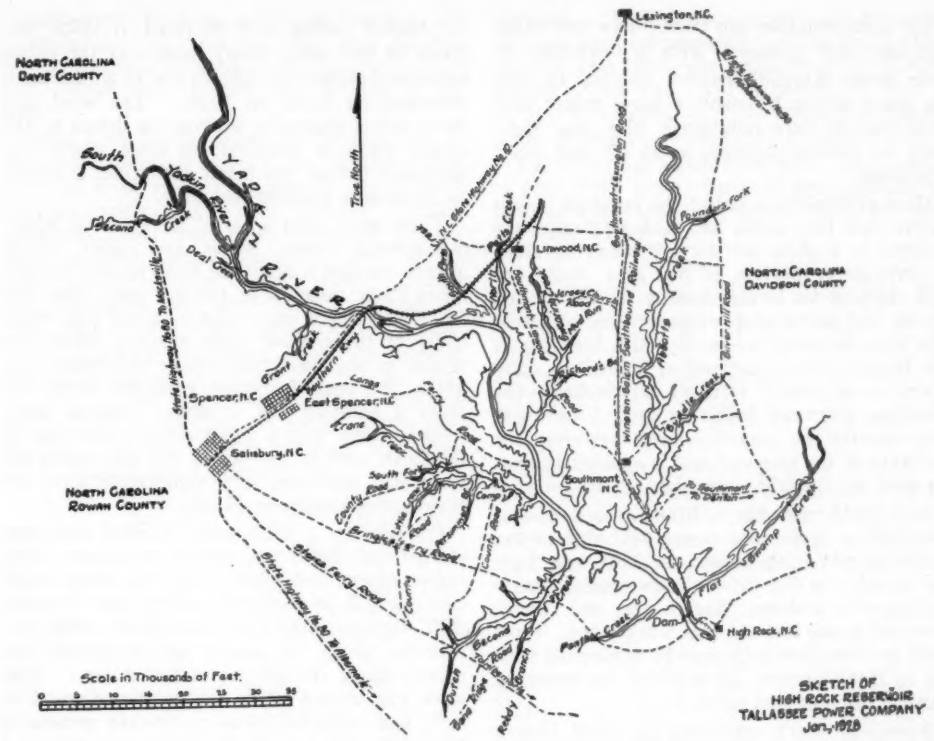
*Read before National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Twenty-Fourth Annual Meeting, Louisville, Kentucky, November 11-14, 1930.

†Superintendent, Tallassee Power Company.



In building this camp there were utilized fifteen tents formerly used by the clearing crews. The sizes and uses to which these tents are put are as follows:

No.	Size	Purpose
2	20x30	Warehouses
1	20x30	Kitchen
2	20x30	Colored bunk houses
1	20x30	Colored mess hall
1	20x30	Colored wash house
1	20x30	Office
1	16x20	White mess hall
3	16x20	White sleeping quarters
1	12x15	Cooks' quarters
1	12x15	White sleeping quarters
1	12x15	White wash house
15		

Both wash houses are equipped with modern plumbing, have hot and cold running water, shower baths and toilets, all of which discharge into a septic tank.

The camp has accommodations for ten white men and sixty colored laborers. During 1928 the personnel of this camp consisted of five field men, one of whom is in charge and supervises and directs all work, two labor foremen, one repair man and one white man whose principal duties are truck driver, camp foreman and timekeeper; also a crew of sixty colored laborers selected from the men who had just completed the clearing of the reservoir area.

The camp water supply is taken from a six-inch drilled well 145 feet deep, cased to rock and equipped with a Meyers deep well pump driven by a 6 horse power gasoline engine, which will pump a maximum of forty gallons per minute.

In addition there is a tool and repair shop in which are kept all hand tools and repair parts needed for the job. There is a power driven grindstone and emery wheel and a small forge so that all tools and equipment can be kept in first-class condition.

The building of the camp was started December 1, 1927, and completed January 15, 1928, but work was suspended several times on account of bad roads and weather conditions. However, the men engaged in sanitary and mosquito control work began occupying the camp January 1.

For transportation two twenty-five foot cabin launches, each powered with a 4-cylinder 15 horse power Kermath engine, and six 15 foot row boats driven by small 4 horse power outboard motors were purchased; also one light truck for hauling supplies, spray oil, and other equipment.

More efficiently to patrol the reservoir it was divided into four areas, and each field man was assigned to a given territory, it being his duty to cover every portion of his area every ten days, dipping for larvae, looking for the winged insects and performing whatever control measures were necessary to destroy such breeding as was found. Each man makes a detailed daily report on a printed form of his findings, observations and work done that day. From these daily reports the man in charge perceives the condition of the reservoir and is enabled to plan the work for the labor crew the following day.

Each field man has a fifteen-foot row boat propelled by a 4 horse power outboard motor, two axes, two bush hooks, one rake, one fork, one shovel, one five-gallon compressed air knapsack sprayer, and one Niagara dust gun. Larvicides and motor fuel are drawn as needed. From April to November each year he is assigned from one to three laborers, as required, for spraying, dusting, ditching and other work.

After one year's operation the small 15-foot boats powered with outboard motors were found unsatisfactory, as they were not seaworthy. On windy days they were swamped frequently and on other occasions when the wind increased the lake became so rough that the men were unable to return until late at night. It was found that these boats were too small to carry the equipment and supplies necessary for a day's work. Consequently, in May, 1929, they were replaced by larger and faster boats, operated with electrically started inboard motors. These larger boats are entirely satisfactory and enable the field men to cover their territory faster, accomplish more, and lose less time in going from one locality to another.

The closure of the dam was made November 7, 1927, and as the reservoir began to fill, the water picked up and floated vast quantities of fine drift such as corn stalks, weeds, weed seeds, leaves, small twigs and a considerable amount of logs, poles and other heavy drift which was overlooked or not completely burned by the clearing crews. The water gradually rose until December 19, 1927, when the lake was within four feet of being full. After December 19, the water started falling, and on April 1, 1928, was down 14 feet, when heavy rains over the entire watershed caused the lake to rise to a maximum elevation on April 14, 1928. The wind and wave action gradually worked the debris to the shores where it stranded; in some places the drift and flotage was a few feet wide, in others as much as a hundred feet wide.

There were great areas of the reservoir where the sprouts, briers, weeds and other native growth reached a height of from two to six feet. After these areas were cleared, and when the lake filled, there were miles of shore line, especially in the shallow creek sections where the second growth protruded above the water, and which in some instances extended from the shore a hundred feet or more. Around these sprouts there was a considerable collection of fine drift and flotage which did not reach the shore and prevented any appreciable wave action in that particular place.

On January 1, 1928, active control work was started and during the months of January, February, March and April, 1928, the entire force was engaged in removing, piling and burning drift, flotage, trash and other debris which had collected along the shores and in cutting the growth along the margin of the water. This work was started where the greatest amount of drift had collected, close to thickly populated localities, also in such areas as were potential breeding places for the Anopheles mosquito.

During the first three and a half months of the year the lake gradually fell fourteen feet below its maximum elevation. In this period the drift and flotage on approximately 50 per cent of the reservoir was collected and burned along about 170 miles of shore line, which comprised approximately 80 per cent of the total amount of drift and flotage which had accumulated.

When the lake filled on April 14, 1928, it floated the remaining drift, and within three days it had been drifted along shore by the wind and waves. In addition the flood in the first part of April had brought down much more additional drift and flotage.

From May 1 throughout the balance of the year 75 per cent of the labor crews with two foremen were engaged entirely in removing drift and flotage from the margin of the lake, cutting sprouts and briers along the shore and working in such areas as the daily reports of the field men showed needed immediate attention. The remaining 25 per cent of the labor was employed from May 1 to November 1 applying

larvicides and ditching, under the direction and supervision of the field men, and after November 1 they were engaged in the removal of drift and flotage and cleaning the margin of the lake.

From April to November, 1928, there was an excessive amount of rainfall over the watershed. Some of those rains were general over a large territory, while others were confined to comparatively small areas, and on numerous occasions extremely heavy local rains were falling almost entirely within the lake itself. During the year there were numerous floods on the river, some of which were quite close together.

The following tabulation shows the number of days in the months of April to October, both inclusive, for the years 1928 and 1929 in which rain fell on the lake and the total monthly precipitation, also the average minimum and maximum temperatures for each month:

	No. Days Rain Fell	Total Precip.	Temperature Max.	Min.
1928				
April	11	3.84	71	61
May	10	3.96	77	57
June	9	3.20	82	63
July	6	1.02	91	70
August	7	3.01	92	69
September	10	12.30	76	60
October	1	.53	72	55
1929				
April	9	3.37	79	50
May	12	3.51	83	59
June	15	6.15	85	64
July	12	2.43	87	67
August	6	1.36	88	67
September	14	1.43	79	63
October	6	7.33	67	48

Due to the excessive rainfall throughout the entire summer season, the production of both Culex and Anopheles larvae was heavy in sections of the lake and its vicinity. This with extremely warm weather during the months of July, August and September resulted in ideal conditions for the production of mosquitoes, and from the standpoint of mosquito control work conditions scarcely could have been worse.

On April 25 the first Culex larva, and on April 26 the first Anopheles larva was found in the lake, and after this date larvae were found in ever-increasing numbers until the first week in September, when they reached their peak, after which they declined until the first heavy frost on October 25.

During the latter part of 1928 the upper river and creek sections began showing an increase in production, as there were many large flat shallow areas in these sections, in some portions of which the water was only a few inches deep and bull rushes, cattails, arrowheads and other aquatic and semi-aquatic growths were getting a foothold. Much of this growth was destroyed, but new seedings promptly took its place. During this year there was applied a total of 4,091 gallons of oil and 1,102½ pounds of dust as larvicides, whereas in 1929 there was applied 2,843 gallons of oil and 9,345 pounds of dust.

The following tabulations show the quantity of dust, Paris green, waste oil and kerosene applied as a larvicide each month during the years 1928 and 1929:

	1928			1929		
	Oil Gals.	Ker. Gals.	Total Gals.	Oil Gals.	Ker. Gals.	Total Gals.
April	65	6	71	180	18	158
May	385	30	415	370	35	405
June	440	38	478	415	35	450
July	795	69	864	520	50	570
August	600	66	666	570	52	622
September	1012	95	1107	450	41	491
October	453	37	490	98	9	107
	3750	341	4091	2603	240	2843

The waste oil used was obtained free of cost from filling stations and oil companies in the near-by towns, and was collected weekly by the camp truck. This oil was strained and a sufficient amount of kerosene added to bring it to a suitable consistency.

	1928			1929		
	Paris Green Lbs.	Dust Lbs.	Total Lbs.	Paris Green Lbs.	Dust Lbs.	Total Lbs.
April	4	75	79	5	100	105
May	3	50	53	9	175	184
June	4	75	79	25	500	525
July	9	175	184	76	1525	1601
August	7	150	157	107	2150	2257
September	21	425	446	130	2600	2730
October	5	100	105	93	1850	1943
	53	1050	1103	445	8900	9345

In 1926 a large gambusia hatchery was built, which supplies large quantities of minnows. During the years 1928 and 1929 the hatchery furnished over two million gambusiae, which were placed in the arms of the lake and in many large drainage ditches emptying into the lake in which there was eddy water. These gambusiae multiplied and spread rapidly and are very effective in many areas of the lake.

On November 1, 1928, the labor crew on the lake was reduced and only a sufficient number of men were employed during the winter of 1928-29 to remove accumulations of drift and flotage, and to clean certain creek and ditch banks and portions of the shore line.

From April to November, 1929, the number of laborers employed was 30 per cent less than for the same period of the preceding year. Those laborers not employed by the field men in oiling, dusting and ditching were engaged in the removal of flotage and drift, and the de-

struction of cattails, willows, bull rushes and other aquatic growth. The number of field men and foremen employed was the same in 1929 as in the preceding year.

During 1928 the per acre cost of all control work amounted to $4.37 per year, and in 1929 the cost was reduced to $2.94 per acre; it will be further reduced during the year 1930.

The reservoir is now over two years old, and as a result of the control measures which have been taken the malarial conditions in the territory adjacent to the lake have been improved considerably, Anopheline production has shown a decided decline, and the people who live near the border of the lake, or very close to it, have made no complaints of mosquitoes or health conditions. The lake is now used by several thousand people for fishing, boating, bathing and recreation and instead of being a menace to health it is recognized as a valuable asset to the neighborhood, thus indicating that the results of the sanitary work are highly satisfactory.

The following is a brief summary of the cost of clearing the reservoirs of five completed hydro-electric projects, four of which are in North Carolina and one in Tennessee:

No. 1—High Rock Development. On the Yadkin River in Piedmont Section of North Carolina:
Shore line, 365 miles
Surface area of reservoir, 16,000 acres
Actual area cleared, 9,790 acres
Total cost of clearing.....$807,342.00
Net receipts from sale of timber..... 129,468.00
Net cost of clearing.....$677,874.00
Net cost of clearing per acre..... 69.00
Clearing of this reservoir was started September 1, 1926, and completed January 1, 1928.

No. 2—Narrows Development. On the Yadkin River in Piedmont Section of North Carolina:
Shore line, 75 miles
Surface area of reservoir, 5,600 acres
Actual area cleared, 3,750 acres
Net cost of clearing.....$150,000.00
Net cost of clearing per acre..... 40.00

No. 3—Cheoah Development. On Little Tennessee River, on Smoky Mountains of Western North Carolina:
Shore line, 22 miles
Surface area of reservoir, 700 acres
Actual area cleared, 300 acres
Cost of clearing.....$40,967.00
Cost of clearing per acre..... 136.00

No. 4—Santeetlah Development. On Cheoah River in Smoky Mountains of Western North Carolina:
Shore line, 20 miles
Surface area of reservoir, 2,750 acres
Actual area cleared, 2,647 acres
Cost of clearing.....$120,968.00
Cost of clearing per acre..... 45.00

No. 5—Calderwood Development. On Little Tennessee River in Smoky Mountains of Eastern Tennessee:
Shore line, 20 miles
Surface area of reservoir, 500 acres
Actual area cleared, 176 acres
Cost of clearing.....$28,344.00
Cost of clearing per acre..... 159.00

The land in Developments No. 1 and No. 2 is rolling to flat, with rather wide creek and river bottoms upon which the timber was extremely large and dense, all of which, however, was very accessible.

The land in Developments Nos. 3, 4 and 5 is very rugged mountain land, quite inacessible, side hill work and along a very narrow strip, which features contribute to the high cost of clearing.

DISCUSSION (*Abstract*)

Dr. F. M. Boldridge, Charlotte, N. C.—I think Mr. Clark's figures on clearing are entirely too high.

The Duke Power Company, with which I am connected, is concerned with problems very like those of the Tallassee Power Company, of which Mr. Clark is Superintendent. We have 32 ponds in North and South Carolina. These 32 ponds have a total of 140,000 acres of impounded waters. Our clearing, taking 8 of the major projects, was done at a cost of $20.75 per acre, that is, the original clearing. We have to go over the entire area. I think some scheme should be devised by which we can lower pond clearing. Up to a few years ago, a new concern would go into an area, clear up, and let the pond fill up in the spring; then in the early fall we had malaria, and the community protested that there was malaria which it had never had before, and the result was usually several hundred thousand dollars in law suits. If a company wants to get down and out, let public sentiment turn against it. When it has a batch of law suits it will go down rapidly. Most companies realize this and in the last few years have made every effort to keep their ponds clean and in sanitary condition and see that the laborers who are used in the developments are protected against malaria.

I have just jotted down a few figures. We completely cleared one lake, 6,500 acres, which is not a large pond, 175 miles long, original cost $124,635.22, or $19.25 per acre. Now, it is true that labor on that pond cost $2.00 per day, and the labor item is the most important item of this; another pond, 35, $18.75; another pond, 40, $90,022.14; another, 3,250, $67,870, $20.00 per acre. We had one pond fully twenty years ago, before we knew anything about pond clearing. We cleared about one-third of the pond; the original clearing cost twenty years ago, $66,000. Five years ago we spent $85,000 more on it. It was at that time a menace to the health of everybody in the community. I think that when power companies know malaria, and know that they must help to eliminate it, they will get the general sympathy of their employees and the people living in the areas will be better off. Mr. Clark's figures on ponds are mostly sanitary work.

On our 140,000 acres of impounded water I have

charged up this year a cost of 34 cents per acre. That is rock bottom.

Mr. Clark's concern made a very elaborate malaria survey before impounding the water. Eight years ago I filed some records which I believed I would never need. Our general attorney called at my office last spring and asked me about certain people living in this area who were talking about bringing suit for malaria against the company. I looked back in my records. In this family of seven five gave a history of malaria two years before the impounding project. I had not only the personal history, but had a record from the family physician. All I had to do was to give this to the lawyer and when he told their attorney they had had malaria previously he knew it was useless to bring suit.

The pond should be closed in the fall of the year from water. It is criminal to impound a big body of water in the summer time without sanitary conditions. Especially in Carolina, all impounded waters will breed mosquitoes. I am a confirmed believer in Paris green, but to the public a mosquito is a mosquito. The average layman does not know Anopheles or Culex, but when he gets malaria it comes from a pond and he gives the company a lot of adverse criticism.

We try to educate people and school children. We have lantern slides and go to the country schools within 20 or 30 miles of our projects. We have some areas where every child can tell the types of mosquitoes.

Dr. S. R. Benedict, Birmingham, Ala.—The first development of the Alabama Power Company resulted in many malaria suits against the Company. This development was known as Lock 12 and no steps were taken relative to clearing.

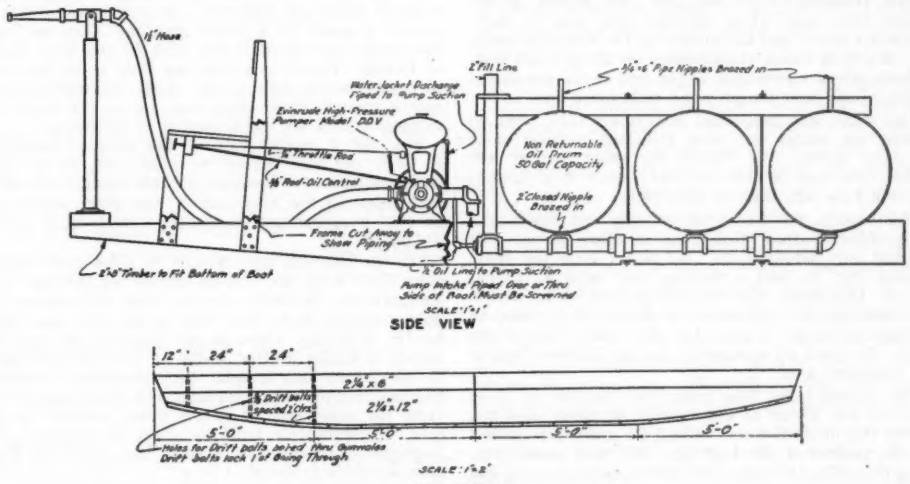
Our next development was Mitchell Dam, twelve miles below this first dam on the same river, the Coosa. To prevent a recurrence of these suits, we put in the most extensive malaria control measures known at that time. To begin with, we collected evidence in every way possible. First, we had a complete malaria survey made; in other words, a survey looking into the possibility of malaria among inhabitants of the basin and within a mile radius of the high water. These histories were very carefully taken and on every person living in the basin a blood smear was made and examined in our private laboratory at Mitchell Dam.

We next went into the question of anopheline breeding around the residences. We caught and mounted mosquitoes found in barns and residences, and we went further and made dippings in springs and branches in close proximity to residences, taking this water to the laboratory and hatching different forms of water life, principally wigglers. Many of these developed into anopheline mosquitoes and were mounted in the laboratory. The many details of these procedures I will not go into here. Suffice it to say that these mosquitoes were mounted on slides by using water glass and could be put under a microscope at any time for identification.

A most elaborate system was put into effect whereby there could be no mistake relative to histories or collection of other evidence. After the complete histories and other evidence were obtained, all this information was put into large envelopes, sealed by the technician and sworn to.

Each man who went into the basin to do clearing work was thoroughly examined. A blood smear was made and if this proved to be positive, or if he had a positive history of malaria, he was not allowed to work in the basin at all. We did not want it said that we had introduced infected men into the basin.

We have had numbers of large hydro-electric developments since the construction of Mitchell Dam, but the largest is Lake Martin on the Tallapoosa River. Here we had a shore line of 720 miles, approximately 40,000 acres, and we had a different situation from any we had dealt with before in that Lake Martin is a storage reservoir. Our problems here were very different from those at our other developments and were most difficult, in that the water was raised during the summer months. In discussing malaria control on Lake Martin,



Alabama Power Company Oil-Water Spray Unit.

I am going to take the high level mark, as it took the lake three years to fill to this point.

I frankly think that Mr. Clark's figures are too high on his malaria control. We have been able to handle the situation at much less expense. We had wonderful cooperation from the State Board of Health, particularly from Dr. S. W. Welch, who, in my opinion, was one of the greatest health officers that this country has ever seen.

Lake Martin was brought up in the summer time, a most difficult situation, but the question of delay in raising water in the lake, backing it up into grasses, is one that must be paired against the loss so far as the generation and sale of power is concerned over a period of months.

The cost of clearing Lake Martin's basin was approximately $1,500,000.00, and the reclaimed lumber probably amounted to $100,000.00. We spent many thousands of dollars on spraying and one of our most effective methods was the water-oil unit which was developed by the Engineering Department of the Alabama Power Company. This was original, we are sure, with the Company, as we have been unable to find any records showing that this idea had ever been used before.

I believe that the most important single factor in malaria control is the raising and lowering of the water level two to three feet at given intervals. It saves thousands and thousands of dollars on labor and oil and gives quicker and better results. We have been through the whole gamut of malaria control measures, from the gambusia ponds up and down the line, and we feel that a well cleared basin with a well kept shore line, plus the raising and lowering of the water at regular intervals, accomplishes more, perhaps, than all other procedures combined.

Dr. L. T. Coggeshall, Chicago, Ill.—I had control of a lake during the past summer which covered 76 square miles. Our clearing costs ran to $1,450,000.00, which averaged $37.00 per acre. We started in the spring two years before anything was done to make a malaria survey and the slides that Dr. Boldridge spoke of. We took blood examinations on about 4,800 individuals, which represented 90 per cent of the population living in and near the proposed high water line.

Our water was impounded in October, 1929, went up during the winter and then this past summer came up very slowly. We figured the shore line at 400 miles. The lake is only half full; when it is finished we will have 585 miles of shore line.

For control, we use an oil spraying unit which is a little different from that used in other places. It worked very satisfactorily. We had a large tug boat; behind that we had a floating tank with 42 barrels of oil. Operations were started on May 17 to control this lake and the tank made 21 circuits of the lake, an average of about 8 days for the round trip of the lake. We used oil exclusively, as the Culicines had to be controlled also.

We started using Paris green, but because we knew that oil was giving us our control we made only one round trip of Paris green. The Paris green was applied by the method of Mr. LePrince. We went a little further than Mr. LePrince. We had a generator and had electric lights in our sleeping quarters all summer. The oil method is the same as that described by Dr. Benedict. Oil and water are mixed in a proportion of 1 to 100.

Labor for this year consists of three sets of men: two men to the boat running these oil bats, also a general foreman and an inspector. We paid our men 22 cents and 17 cents per hour, the man running the boat getting 22 cents and the man that did the spraying 17 cents. This, of course, did not represent the true value of these men, but we have a waiting list of 500 willing to step in. Labor was $700.00 for the summer; oil and Paris green, $4,000.00. At first, we started out with paraffin oil, black oil and kerosene. We used that the first three months and the last three months used 50 per cent kerosene and 50 per cent crank case oil that was strained. Our sprayings for each trip around the lake cost us $800.00 for the summer. Our boats and equipment, $11,000.00; maintenance, insurance and overhead cost us $2,000.00. In all, the cost of this lake was $26,000.00 for the summer. Figuring out on a mileage basis the cost was $3.00 per mile for every mile of shore line, making the round trip twenty-one times.

Mr. Clark (closing).—Our cost of clearing per acre is based on the acreage actually cleared and not on the total acreage in the reservoir, a large portion of which was already cleared and in cultivation. If we considered this acreage cost on the entire acreage in the reservoir it would reduce the clearing cost from $69.00 per acre to approximately $40.00 per acre. We keep complete and accurate records of all clearing costs, as we find such records of great value when it is necessary to make estimates on some future contemplated development, as it is not only advisable but necessary that any estimates made for such contemplated work be as nearly accurate as possible.

Like Dr. Boldridge, we felt that all the data we could secure pertaining to health conditions within and about this contemplated reservoir prior to the impounding of the water would be extremely valuable, consequently did everything possible to induce the State Board of Health to make a thorough mosquito and malarial survey of this area. In our opinion such a survey, if made by a power company, does not have the weight and effect of one made by the State Board of Health. People as a rule pay little or no attention to mosquitoes in their vicinity until an artificial reservoir is created, after which they are on the watch for mosquitoes and are highly critical of conditions.

The cost of control work on this reservoir amounted to $4.57 per acre during the year 1928, or in other words, $70,000.00. However, of this amount $21,000.00 was expended for boats, camp and other equipment. In 1929 we purchased six additional boats at a cost of $12,000.00.

On our Narrows lake, located 20 miles down stream from High Rock, the cost of control for the year 1929 amounted to $6,500.00, and in 1930 will amount to approximately $4,300.00. This is the lake mentioned by Dr. Boldridge, where at one time we had approximately a million dollars' worth of law suits pertaining to mosquitoes and malaria. It is necessary to control the breeding of both Anopheles and Culex mosquitoes, from the standpoint of people living adjacent to the lake. Unfortunately both the cities of Salisbury and Lexington discharge raw sewage into our High Rock lake, which is unlawful.

Dr. Benedict states that it greatly simplifies control work to lower the elevation of the lake during the

summer months and that it greatly reduces the cost of such work. However, water is our stock in trade, and it would be out of the question to expect our Company deliberately to waste one, two or three feet of water during the summer months when ordinarily we are making every effort to conserve it.

Dr. Benedict further states that for the purpose of controlling the growth of willows it would be a good idea to clear these reservoirs just in advance of the rising water. This does not always work, as no one has any means of telling just how fast the water might rise and in the event of a flood on the river, such as we had in the summers of 1928 and 1929, the water would rise and fill the reservoir long before clearing operations could be completed. We find that willows spring up very fast and that in certain areas, which previously were cultivated fields, the willows are now as thick as grass.

We cannot use oil exclusively on account of the large area of very shallow water where boats or tugs cannot navigate.

We pay our darkies 25 cents per hour, whereas Dr. Coggeshall pays his men 17 to 22 cents per hour.

We consider it useless to clear a fifty-foot margin around the lake. It is a detriment to control work, as a tree standing on the margin of the lake will cause no trouble, whereas when you cut these trees down you then have a constant fight against sprouts. In our case, to clear a strip fifty feet wide around the margin of the lake would amount to 1,700 acres of additional land to be cleared at a cost of $102,000.00, and would do no earthly good so far as we can see. Our maintenance costs have been materially reduced each year. During 1929 our cost amounted to approximately $45,000.00, whereas this year (1930) it will not exceed $35,000.00.

THE MANUFACTURE AND LIFE OF SCREEN WIRE*

By JOHN G. RALSTON,†
Dixon, Ill.

Wire screen cloth for protection against insects is commercially made from two kinds of wire, steel and bronze or copper. The wire in both cases is drawn cold, through a series of dies, from rods in large coils down to the weaving-wire gauges. In the process of drawing, there are stages at which the wire must be cleaned and annealed to prevent over-hardness and to permit drawing to the finer sizes. It is interesting to note the amount of reduction by the statement that one foot of steel rod makes five hundred lineal feet of fine weaving wire.

The process of weaving this wire is similar to the weaving of other fabrics. The warp wire is wound on a large drum, which is placed in the loom. The wires needed for the width and mesh of screen cloth to be made are threaded through the heddles and reed. When the loom is in operation, the filler or cross wire engages the warp wires and is beaten up into position to form the correct spacing. After several hundred lineal feet of the fabric have been woven, this strand is cut from the loom and taken to the measuring, inspecting and finishing departments. We now have a large roll of bright steel wire cloth which may be finished with a coating of black enamel paint, to make the least expensive screening, or it may be electro-galvanized or electroplated with zinc, to make the grey dull-finish cloth which is a little more expensive than the painted.

Black Painted Wire Cloth.—The steel wire fabric is run through a bath of paint, the surplus being pressed and blown out to prevent filled meshes, and is then dried in a heated tower. The preparation of the wire, the quality of the paint, the method of application, and the degree of coverage all determine the quality or life of this class of screen cloth. There is a decided difference between the best and the poorest painted cloth.

Electro-Galvanized Wire Cloth.—The process of electro-galvanizing with zinc, after weaving, requires very large electrical machines, large tanks for the chemical solutions, and a great deal of electric power. Generally speaking, the process consists of chemical solutions in which are suspended zinc anodes or bars of zinc, minute particles from which are passed through the solution by the electric current and deposited on the steel wire, leaving a uniform layer of chemically pure zinc to protect the wire. The repeated immersion of the fabric, or the length of time it remains in the solution, serves to build up the zinc deposit to a given standard of quality. There are as many different ways of finishing the cloth by this process as there are factories making it, and to the unpractised eye the results are more or less the same. There may be, however, a great difference in the character of the zinc deposit, which is of greater importance than the quantity of the zinc used, and this distinguishes the relative quality of any two or more pieces of screening, although to the eye there may not be an appreciable distinction. It is therefore quite incorrect to assume or to state that one piece of galvanized screening is as good as another. The length of service under exposure determines the quality of manufacture.

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†President, Reynolds Wire Co.

Bright Galvanized Wire Cloth.—There is another variety of steel wire cloth which was once an important commercial factor, but has been largely supplanted by the electro-galvanized or dull-finish screening. This is called bright galvanized wire cloth. It is made from wires individually galvanized, before weaving, by the one-coat hot-galvanizing process. The wires are pulled through a bath of molten zinc, wiped off, and cooled. This wire, with a thin skin of bright zinc, is subjected to bending and scraping in the loom. Considerable damage is done to the coating, which cracks and flakes off to such an extent, as a rule, that the steel wire at intersection points is exposed to early rust. This bright wire cloth is now more expensive than electro-galvanized, and does not usually give such satisfactory results.

Bronze and Copper Wire Cloth.—Bronze and copper wire are drawn and woven into screen cloth much the same as steel wire, but when taken from the loom they require no finish. So-called "pure copper" wire makes a soft fabric and not the best quality of screens. It is slightly cheaper than copper-bronze wire, which is made from an alloy containing 90 per cent copper. This has higher tensile strength than copper and makes a fabric that is easier to stretch tightly on screen frames and that is more resilient. It will spring back into place after pressure of thumb or hand, and holes cannot be punched in it so easily. This grade of screening is used by the best class of trade in preference to copper. Bronze screening is usually of a bright copper finish, but is also furnished in a dark or oxidized color, preferred by some architects and builders.

STANDARD SIZES

Standard screen cloth is furnished in rolls of 100 lineal feet, and in widths from 18 to 48 inches, in 2-inch steps, or even-inch widths. Standard meshes are 12, 14, 16 and 18 mesh or spaces per inch each way. Warehouse stocks over the country consist of any of the following kinds of cloth:

Black painted	12 mesh
Galvanized	12, 14, 16 mesh
Bronze or copper	14, 16 mesh

More general use of 16-mesh is recommended for the best protection against insects. We are advised by your Committee that nothing coarser than 16-mesh will keep out the Anopheles mosquito, and therefore it is of vital interest that manufacturers, jobbers, dealers and health officers lay special stress on the use of 16-mesh screening, or 18-mesh when required, especially in the malaria sections. Care should be taken to see that the screening used is really 16-mesh or 16x16, and not 14 or 15x16. The latter spacing is an indication of poor and inaccurate weaving. Since insects will invariably find the largest hole to crawl through, it is important to make sure that 16-mesh protection is really furnished; otherwise 18-mesh might be necessary, and this adds to the screening cost.

DISTRIBUTION

Wire screen cloth is manufactured in different parts of the country, and is only sold from the factory on a wholesale basis. It is distributed through wholesale hardware or jobbing houses and other large merchants, and is sold to the regular millwork companies who manufacture screen frames for windows and doors. The wholesale distributors make delivery to the local hardware and building supplies dealer, where the individual may purchase any number of feet required.

LIFE OF SCREENS

We are all interested in getting the most for our money, and people who screen their homes, while desiring to do so most economically, should not consider the initial cost so much as the average annual cost of the installation. A screen which will last, without replacement, for five years is much cheaper than a screen which will rust out in one season. Yet such variation does exist as between different kinds of screen cloth which look more or less alike, and for various reasons, the most important being the difference in manufacture and the irregular conditions of exposure. The question is often asked: "How long will this screen last?" It is impossible to answer this question correctly, as the life of screening is relative. If two identical pieces of screening are put on a house, each on a different side, one of them may last considerably longer, due to the varying conditions of moisture, air and wind. A piece of screening in a dry climate will last longer than the same piece on the seacoast, or in some manufacturing district where the gases in the air are harmful, or near some river or swamp where there is almost continual moisture.

Screens that are kept up all the year round and are subjected to all kinds of weather will not last so long as screens that are put up during the insect season and stored in a dry place during the cold weather. Screens that have

vines, shrubs or trees growing near or against them will not last so long as screens on the open side of a house. Under average conditions, any screen cloth made from a steel wire sooner or later will rust, and its life depends upon the length of time it takes for the weather to break down the protecting coat, whether of paint or zinc.

There are ways of prolonging the life of screen cloth, and the obvious way in the case of black painted screening is from time to time, say every year or two, to brush over the screen with a light coating of thin black paint, so that the meshes will not be filled with it. In prolonging the life of electro-galvanized cloth, perhaps once a year the screen may be brushed over with boiled linseed oil. In either case, the dust and dirt should first be brushed out.

Bronze cloth, as well as copper, which costs about three times as much as painted and galvanized cloth, is not affected by the usual weather conditions to the same extent as steel cloth. It does oxidize, and at times turns green and causes staining of woodwork, for which the manufacturer never assumes any responsibility, since this type of corrosion is inherent in the metal itself. While bronze cloth does not "rust," because it contains no iron, nevertheless corrosion takes place, producing a green verdigris, just as iron produces a red rust. In the case of bronze and copper, this corrosion starts immediately but progresses slowly. Along the seacoast this action is rapidly accelerated by the salt air, and combined with the whipping action of the wind, the wires become crystallized, and failure results in a comparatively short time.

For high class homes, where initial cost is secondary and where convenience is of greater consideration, bronze cloth is usually preferred to steel cloth. It is, however, always subject to failure by abuse and mechanical injury such as might be caused by a chair, a child or a dog.

In conclusion, the most practical and economical wire screen cloth for use in anti-malaria work is electro-galvanized, dull-finish cloth, 16x 16 mesh, and the best quality obtainable. This has been proven in tests made by the Government, the health department and others.

The costs of screening with this class of material are within the reach of any landlord or householder.

DISCUSSION (*Abstract*)

Dr. L. W. Hackett.—I would like to ask why stainless steel has not been used?

Mr. G. Watson.—It has been used, but not commonly because of the cost.

Mr. Ralston.—I would like to answer that question by saying that it is not always stainless.

Dr. Hackett.—May I ask why it should be so expensive; why should it not be used for cloth?

Mr. Watson.—The cost of stainless steel makes it out of favor.

MALARIA CONTROL ACTIVITIES IN THE UNITED STATES IN WHICH THE INTERNATIONAL HEALTH DIVISION OF THE ROCKEFELLER FOUNDATION COOPERATED DURING 1930*

By JOHN A. FERRELL, M.D.,
New York, N. Y.

During 1930 the participation of the International Health Division of the Rockefeller Foundation in cooperative projects against malaria in the Southern states has been somewhat less than in previous years. Only one member of the staff, Dr. Mark F. Boyd, has engaged in the work as his chief responsibility. After conducting stations for field studies regarding malaria in Brazil, southwestern Georgia and eastern North Carolina, he began to serve in Mississippi in the spring of 1929 as a member of the staff of the State Board of Health, with the title of malariologist. During the past two malaria seasons he has experimented with the possibilities of integrating practical measures for malaria control with other local health activities undertaken by the various county boards of health.

Malaria surveys were conducted in a number of Mississippi counties. The anti-malaria measures in the counties in the main involved minor drainage and the screening of homes. The International Health Division's financial aid in Mississippi is toward a Central Administration budget and limited aid to county budgets in Hinds, Pearl River and Holmes counties. Assistance to the Central Administration items, either for medical epidemiologists or sanitary engineers to engage in malaria control measures has also been granted to Georgia, Louisiana, South Carolina, and Virginia. Although it is expected that the county health organization programs will include malaria, wherever this disease is important special grants

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in addition to those mentioned for Mississippi have been made during 1930 specifically for malaria work to Washington County, Georgia; Florence County, South Carolina; Henrico County, Virginia, and the following health districts in Virginia: Southampton-Sussex, Norfolk-Princess Anne, Northampton-Accomac, and Brunswick-Greensville.

The administrative and statistical staffs of the New York office of the Division made a study of the malaria mortality in the various Southern states over a period of years, and the data have been made available to the various state departments of health of the South and other interested agencies represented at the National Malaria Committee meeting at Louisville.

MALARIA CONTROL IN ALABAMA*

By J. N. Baker, M.D.,†
Montgomery, Ala.

Alabama during 1929 experienced a very high incidence of malaria and there were a total of 430 deaths attributed to this cause. This high incidence was reflected during the early months of 1930 by an unusually large number of relapses. The extremely dry weather this summer, however, reduced the breeding areas and as a result there has been a marked falling off in cases, August, September and October having only about 27 per cent of the number of cases reported during the same period of 1929.

The activities of the State towards control have been conducted along the following lines:

(1) The control of impounded water areas is a function of the Bureau of Engineering. The actual work is conducted by the various companies, but reports are made weekly as to work done and the amount of breeding going on. Periodic inspections are made by State engineers. The larger impounded areas have given little trouble, but some of the smaller pleasure ponds have been difficult to supervise and maintain as a non-menace.

(2) In the various county health departments much of the control work is conducted by the sanitary inspector, under the supervision of the county health officer. During 1929, the State gave a one-week course in practical malaria control to fifty such inspectors and to three of its county health officers from counties having the greatest problems. This course included lectures and demonstrations of oiling, Paris green, ditching (dynamite) and screening. It also included a survey of a malaria focus.

(3) Urban mosquito control in the organized counties is usually under the direction of the county health department.

(4) In three counties during this year, a county-wide screening program was instituted. In each of these the State furnished a full-time inspector to assist the county health department with the program. In addition, the services of three engineers have been devoted to the initiation of this work. Whereas only about seventy-five homes have been screened in these three counties to date, the foundation has been laid for a further and more intensive prosecution of this program next year.

(5) An educational program has been launched. Included in this is the use of films of local activities, particularly screening.

(6) Drainage has been encouraged whenever feasible and at the present time one $45,000.00 drainage ditch is under way. When completed, this project will relieve a considerable population in the vicinity of Montgomery. Several lesser projects have been completed.

(7) As an experiment, plasmochin compound has been used in two circumscribed areas, using similar areas as controls. Blood surveys were conducted at the beginning of the experiment and repeated at the end of October. While results are not available, it is planned to submit later a somewhat detailed study of these surveys, together with such conclusions as may seem warranted.

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†Health Officer, State of Alabama.

MALARIA CONTROL ACTIVITIES IN ARKANSAS DURING 1930*

By J. F. GARRISON,†
Little Rock, Ark.

Malaria and mosquito control activities under the general supervision of the State Board of Health were conducted by 26 cities and four agricultural schools having a total population of 202,500 in a total controlled area of 116 square miles. Final financial statements for all of the controlled areas are not available, although 18 of the 26 towns reported a total expenditure of $26,337.07, equivalent to 0.15c per capita. Generally speaking, this per capita expenditure is too small to assure satisfactory work in all communities, particularly the small ones where local conditions present rather large mileage of streams.

Although the most intensive control work was conducted in urban areas, a large percentage of the rural population was aided by full-time county health units in providing measures which have, undoubtedly, reduced the incidence of the disease in the counties having this service.

The Mississippi County Health Unit, cooperating with the St. Louis Southwestern Railway and with the assistance of Dr. Coogle, U.S.P.H.S., made a survey of a large rural area. A summary of this survey, which included 27 rural schools, follows:

Number of families	954
Number of persons	5796
Number showing history of chills and fever in 1930 or 1929	1393
Number of houses screened	548
Number of windows screened	406

A screen door factory was established for the purpose of making the Coogle type of screen door. Operations at this factory began in April. The making and distribution of screen doors was discontinued on the last of June. Up to this time 112 houses had been screened, requiring 236 screen doors and the screening of 412 windows. It is felt that this project was excellently planned and would bring about a large measure of protection in an area where the malaria rate was known to be extremely high. Unfortunately, financial support for the project was withdrawn before it could be completed.

Screening has been recognized in Arkansas as an effective measure against malaria where it has effectively been done, and efforts have been made during the past three years to extend this type of protection to a larger number of people. During 1927-28, following the flood, a large number of homes in the State were efficiently screened, which was made possible by the assistance of the Red Cross with the cooperation of the U.S.P.H.S. While no detailed follow-up check has been made of the screening done at this time, general observations indicate that it has had a most wholesome influence, in that homes actually screened have maintained this protection.

The year 1928 was an unusually high malaria year in Arkansas, showing 181 more deaths from malaria than the year 1926. Nineteen twenty-nine showed a reduction over 1928 of 209 deaths, or 24 per cent.

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†Director, Division of Malaria Control, State Board of Health.

MALARIA CONTROL IN GEORGIA FOR 1930*

By L. M. CLARKSON,†
Atlanta, Ga.

The year 1930 has been a year of exceptional progress in malaria control, chiefly in drainage promotion. Until 1928 there was practically no drainage of consequence for malaria control. The extremely high malaria incidence experienced in 1928 and 1929, together with concerted efforts in promotion on the part of the State Board of Health, brought about a state-wide interest in malaria control by drainage. Today there are in the State twenty-four counties in which drainage for malaria control has been promoted. The size and importance of these projects range from single ponds for community control to county-wide drainage. Some of these counties have made definite annual appropriations for county drainage systems. Some counties have obtained drainage machinery for coun-

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†Director, Division of Sanitary Engineering, State Board of Health.

ty-wide drainage systems and others are now considering such plans for next year.

Control of hydro-electric impounded areas still constitutes one of our chief lines of activities. We have in the State approximately thirty-six hydro-electric impounded areas comprising approximately 150,000 acres. Nearly half of these are of recent development and operating under permits issued by the State Board of Health. These permits require, first, complete clearing of all vegetation before the water is impounded and larvicidal control after the water is raised to the maximum elevation. The power companies today are working in complete cooperation with the State Board of Health. We feel that the crisis has been passed in difficulties of obtaining cooperation from hydro-electric companies. The paramount problem now is the great number and large areas of hydro-electric impounded areas necessitating a great amount of time from our engineering personnel.

Community and town malaria control has been well established by the use of larvicides and by the method of drainage and today malaria as the result of such work is a rural problem. We find that municipal administrators are educated to the great economic value of malaria control for insurance of industrial expansion. There has been a decided stimulus in malaria work in counties with full-time county health officers. The need for malaria control in counties has resulted in establishment of county health units. In many instances valuable malaria control projects have resulted from joint promotion by cooperation between the county health officer and the State Board of Health.

In conclusion, it may be stated that expansion of activities has not been without beneficial results, as our records show that for the year 1930 to October 1, according to mortality reporting, there has been a decrease of 26.7 per cent over the previous year, 1929. We must admit that seasonal rainfall variations have a marked effect upon our malaria incidence, but the deficiency of rainfall during the season of 1930 in our section was by no means exceptional, as was the case in some drouth-stricken states. When we consider effective drainage and other methods of control around concentrated populations there can be no argument against such work as far-reaching in reducing the number of cases and also deaths.

MALARIA CONTROL IN MISSISSIPPI IN 1930*

By MARK F. BOYD, M.D.,†
Jackson, Miss.

The program developed in 1929 has been extended to the eleven Delta counties having whole-time health departments, in all of which it is operating to a varying degree. This program neither features malaria control nor does it contemplate a "campaign" of brief duration. It is designed with due regard to the limitations of county health departments in personnel and funds; their obligation to engage in general health work, and the probability that few, if any, could secure special appropriations for this activity. Thus the control measures promoted must be those which can be financed by those benefitted. This program comprises the following activities, namely:

(a) Encouraging physicians to greater precision in making diagnoses of malaria.

(b) Adoption of a regulation by the State Board of Health requiring physicians to report cases of malaria individually, by name and place of residence.

(c) Requiring county health officers to keep a malaria spot map on which all cases are located at their place of residence.

(d) Preparing educational material, some of which is especially designed to reach the negroes.

(e) Promoting minor drainage.

(f) Promoting the screening and mosquito-proofing of all homes.

The following progress has been made with this program:

(1) *Malaria Diagnoses.*—Physicians are supplied gratis with diagnostic outfits for the transmission of blood specimens to the State Hygienic Laboratory and county health department laboratories. All suitable opportunities are used to urge physicians to use a malaria diagnosis with greater precision, that is, as meaning an infection with malaria plasmodia. In 1929, 9.2 per cent of deaths reported from the State as due to malaria had been confirmed by microscopic examination. In the first eight months of

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†Director, Bureau Malaria Control, State Board of Health.

1930, 16.2 per cent were reported as having been confirmed. In the first nine months of 1929, 806 diagnostic specimens were submitted to the State Hygienic Laboratory from eleven Delta counties. In the same period of 1930 there were received 1,439 specimens.

(2) *Morbidity Reporting.*—In December, 1929, the State Board of Health created a special malaria morbidity reporting district, including all of the counties lying in the Delta wholly or in part, and having whole-time health departments, in which district malaria cases are reportable to the health department individually by name and place of residence. In order to make this requirement less burdensome to physicians, laboratory specimens when positive are accepted *in lieu* of reports when accompanied by sufficient data. We regard this as a measure to be achieved by educational means rather than by coercion. It must be recognized that in the Delta region a physician will probably have more cases of malaria to report than of other reportable diseases, neither can failure to report a case of malaria be justly regarded in the same light as failure to report a case of some other diseases, smallpox, for example.

(3) *Malaria Spot Maps.*—Surveys, repeated annually, are the most accurate means of recognizing local endemic areas, as well as following the annual fluctuations in malaria incidence. However, considering the manifold responsibilities of our health units, the prosecution of recurring annual surveys would expend all of the time which the unit might reasonably allocate to malaria. Other means must be employed to reveal the endemic foci to the health department. A knowledge of the places where malaria occurs is the minimal essential information the health department requires to intelligently develop the control program. This is afforded by maintaining a spot map, upon which is accurately placed a mark or pin representing the place of residence of every case of malaria reported. The old system of reporting malaria neither individualized the malaria cases nor revealed the place of residence. Health officers were mystified and the data could not be practically utilized. We find that the spot maps interest most of the health officers, and they rapidly find they acquire a clearer knowledge of where their local malaria problems occur.

(4) *Educating the Negro.*—We have been convinced that in our Delta section, as in many similar sections of the South, the education of the negro is the key to the malaria problem. It was also our conviction that progress in this direction requires special preparations. We have found the colored posters prepared and distributed by the special committee of screen wire manufacturers of great value, and are anxious that they continue this valuable assistance. Large numbers of these have been placed throughout the Delta, in country stores, negro schools and churches, and railroad waiting rooms.

In order to make visual education most effective in reaching the negro, changes were made in a copy of a 16 mm. edition of the Rockefeller Foundation malaria film. This in the original has scattered human interest scenes illustrating the effect of malaria on a poor white tenant farmer. With the cooperation of the negro teachers at the negro school at Mount Bayou similar scenes were enacted with negro actors, and substituted in the film. We find that negro audiences wax enthusiastic over these scenes and the health departments receive many requests for exhibitions. Exhibition in remote rural sections is facilitated by a kodascope projector, illumination for which is provided by an automobile storage battery. The health officer has found that the negro midwives render valuable assistance in organizing these meetings. These exhibitions serve a very useful purpose in stimulating a demand for screening.

(5) *Promoting Minor Drainage.*—We are extending, as rapidly as possible, part-time engineering service to county health departments. This is effected by the creation of districts, each including three whole-time departments, to which an engineer is assigned, who, as a member of the department staff, spends every third week in a county, giving lines and levels for minor drainage to municipalities and planters without charge. The work is very popular and in each county there is frequently a waiting list of applicants. We now have two such districts. The accomplishments in this direction are summarized below:

MILES OF MINOR DRAINAGE PROMOTED BY COUNTY HEALTH DEPARTMENTS

Eighteen Months Ending October 1, 1930.

	Sur.	Const.
Coahoma County	41.6	14.3
Bolivar County	44.7	14.
Sunflower County	49.6	9.64
*Washington County	6.1	1.2
*Sharkey County	.6	
*Humphreys County	0	
Total	142.6	39.19

*Service in this district only available since August 8, 1930.

The reports of the work constructed are incomplete, as planters are not obliged to report the completion. However, the 37.9 miles of ditches reported from the first district drained 1,804 acres, and were installed by the planters and municipalities at a total cost of $20,341.85.

(6) *Promotion of Screening.*—The results in the first year's promotion of screening are regarded as very satisfactory. Seven counties participated. The distribution of the Public Health Service or standard type of door in the twelve months ending June 30 is summarized below:

Counties	Houses Screened	Doors Installed	Doors M'f'd by Commercial Mft.	Doors M'f'd by Planter	Doors M'f'd by Local Dealer
Bolivar	438*	1709	882	887	
Coahoma	75*	576			576
Leflore	329*	987	30	787	
Sharkey	Not rep.	1277	1277		

*Incomplete report.

A total of 4,737 of these doors were distributed during the year and probably 2,000 houses have been screened. In general we have found the commercialization of their manufacture satisfactory, although some trouble has been experienced from a tendency for the manufacturers to depart from specifications. The problem faced by different counties is unequal, yet it is encouraging to note that in Sharkey County about one-third of the rural houses were screened this year, if there be included good installations not of the standard type.

We have not made the progress we should like in supplementing the screening with papering. It is likely that cold weather rather than fear of mosquitoes will be our greatest aid in securing its extension.

(7) *Malaria Incidence.*—The influence of the great drought of 1930 was felt in all parts of the State. Malaria cases and malaria deaths were reported as follows in 1928 and 1929:

Region	1928 Cases	1928 Deaths	1929 Cases	1929 Deaths
Delta	33224	241	27222	128
Bluff	16847	111	15660	62
Northeast	31724	114	31465	73
South-central	16584	52	15997	46
Coast	506	3	701	7
	98885	521	91045	316

Excepting in the coastal region and adjacent parts of the south central region, the upward trend of malaria incidence during recent years was checked in 1929. Available evidence indicates the drought markedly checked the transmission of malaria over most of the State, and it is probably safe to say that the malaria incidence in most parts of the State during 1930 is the lowest known. This conclusion is corroborated by the morbidity and mortality reports, the results of laboratory examinations, the opinions of practising physicians and the results of surveys.

(8) *Outlook.*—The experience of the present season has demonstrated the practicability and workability of the foregoing program. The control measures promoted are popular and well received. It is possible, however, that in view of the economic outlook for 1931, we may not be able to accomplish as much in 1931 as during 1930. However, it is expected that efforts to extend screening will be redoubled during the coming winter and spring. A number of the county health departments are making extensive use of the negro movies. Any effort is easier if a definite objective is set, and, in view of the interest known, the slogan "Screen every home by 1935" does not appear unreasonable.

MALARIA CONTROL WORK IN OKLAHOMA*

By CLYDE W. BESON, M.D.,†
and
F. R. HASSLER,‡
Oklahoma City, Okla.

An active malaria control program was started in Oklahoma by the State Health Department in the early spring of 1928 and the complete outline of this program has been presented in the Ninth Annual Report of the Department. It may be stated briefly as follows:

OUTLINE FOR MALARIA CONTROL PROGRAM

(1) Estimate of the amount and location of malaria in the district or county.
- (a) From physicians' reports.
- (b) School census.
- (c) Spleen index.
- (d) Blood index.
- (e) Prepare map of district or county.

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†Commissioner of Health.

‡Assistant Sanitary Engineer.

(2) Educational work.
  (a) Newspaper articles.
  (b) Bulletins and printed matter in schools.
  (c) Printed matter and letters mailed out to rural route box holders and to persons whose names and addresses have been obtained from the school malaria census blanks.
  (d) Health talks to schools and community meetings.
  (e) Lantern slides and motion pictures.

(3) Methods of Control.
  (a) Drainage and oiling campaigns for mosquito control in the larger towns and cities.
  (b) Quininization of the malaria cases. Standard malaria treatment furnished free to all indigent cases and to school children. The establishment of "pill drills" in the schools found to be heavily infected with malaria.

This plan has been followed as nearly as local conditions would permit and in counties having full-time health units the work has been carried on by the unit. In the other counties the work has been done by the State Health Department cooperating with some local organization such as the chamber of commerce or the county superintendent of schools. The total expense in these counties has been borne by the State Health Department. Unfortunately there are only three counties in the malaria district that have county health units. The remainder have only part-time health officers.

The malaria district includes about twenty counties, all of which are in the eastern and southeastern part of the State. There are 77 counties in the State. This part of the State is hilly or mountainous, having many rivers and streams and having the heaviest rainfall of any part of the State. There are larger valley areas which are very fertile and in which most of the population lives. The principle crop in the section has been cotton, but in recent years the cotton crop has been small due to unfavorable weather conditions and the invasion of certain insects that have destroyed it.

Economic conditions since 1920 have not been good. Many banks have failed and a large part of the land has been sold for taxes. Very little rural development such as screening of houses or land drainage has been done; in fact, conditions in this respect are probably worse than they were ten years ago. This condition has made it impossible for the counties to contribute toward a malaria control program and has made it necessary to furnish a large amount of free treatment to malaria cases. Physicians have moved away from the district, leaving many localities without the services of a physician.

Malaria surveys have been made by the school census methods and the results of these are given in *Table 1*. These surveys have been made by giving an information card to each school child to be filled out by the parent and returned to the teacher. Eight counties have been surveyed by this method, which represents 4,202 families and 25,190 persons.

A large number of blood smears have been

Table 1

INCIDENCE OF MALARIA IN OKLAHOMA COUNTIES
SCHOOL CENSUS

COUNTY	No. of families	No. of persons	% Pos.
Bryan	858	5,629	22.0
Choctaw	339	2,022	39.9
Coal	459	2,799	29.7
Marshall	280	1,597	16.3
McIntosh	570	3,426	40.4
Love	431	2,376	8.4
Pushmataha	295	1,673	49.0
Sequoyah	574	3,481	34.7

Note.—Census made by sending malaria card to the home from the school. Card was filled out by the parent and returned to the teacher by the student.

made on school children and the results of these examinations show that out of 399 slides 58 positives were obtained, or 14.5 per cent positive. These slides were taken in the school room on children who said that they had been suffering from chills and fever during the past year.

A survey by the spleen index method was made by Dr. H. P. Carr, of the International Health Board, in 1926 and the results of this survey are shown in *Table 2*. We have been unable to make additional surveys by this method due to the lack of trained personnel. It will be seen from the table that Dr. Carr estimates an average infection of 23 per cent in the eight counties surveyed by him.

The malaria surveys and visits to the schools have shown that our malaria is not confined to certain localities or foci, but that it is pretty well scattered over each county that is infected.

This is probably due to three causes: the movement of tenant farmers from one farm to another; cotton pickers coming from the hill to the valley region to pick cotton and then returning to the hill regions, carrying the infection; the lack of proper medical attention and of adequate treatment over a period covering six or eight years.

Our investigations this year in counties that have had the quininization program for two years have shown that malaria in these counties is now pretty well localized and is of the focal type.

It was apparent that the two greatest needs were for an intensive educational program and for the treatment of the cases of malaria already existing.

This program was started in that year (1928) in three counties, the educational work being conducted in the schools and at community meetings held at night; lectures and pictures were given on malaria and its importance and control and a large amount of literature was distributed.

A small portable film strip projector using a storage battery has been used with good success in the one-room rural schools.

Because of the unfavorable economic conditions the State Health Department began the free distribution of quinine to all indigent cases in these counties. This was distributed by the part-time county health officers and the local physicians. The plan was to furnish treatment only to those who were not able to pay for it and to insist that the full eight weeks' treatment be taken. However, by this method of distribution a large number of persons who were not indigents also received treatment.

During the following year, 1929, the work was extended to include two additional counties and the quininization of school children was begun in three of the five counties.

Table 2

INCIDENCE OF MALARIA IN OKLAHOMA COUNTIES
SPLEEN INDEX

COUNTY	No. of Exams.	No. Pos	% Pos.
Bryan	225	47	20.8
Choctaw	209	41	14.1
Canadian	71	3	4.2
Latimer	49	16	32.6
LeFlore	113	39	34.5
McCurtain	309	68	22.0
Muskogee	77	16	20.8
* Muskogee	67	2	2.9
Pittsburg	64	14	21.8
**Pittsburg	21	11	52.3
Pushmataha	295	65	22.0

Note.—Survey made by Dr. Henry P. Carr, of the International Health Board. Examination of school children for enlarged spleen was method used.
*Prairie district.
**Near impounded reservoir No. 3.

This program of treatment for school children is carried out as follows: the teacher is given the proper instructions and provided with the necessary record blanks and quinine capsules. All of the children who are having chills and fever at the time or who say that they have been suffering during the spring and summer are given the treatment. The full standard eight weeks' treatment is given and the capsules are taken in the school room under the direction of the teacher. In many of the larger schools "pill drills" are organized and are held once or twice a day as the treatment requires.

This year (1930) the program includes ten counties and the "pill drills" in the schools are being conducted at this time in four of these and also in a few of the schools that need the treatment in counties that had the "drills" last year. This treatment of school children has been of great value to the schools, as the attendance has increased and the school no longer needs to use one of its rooms for hospital purposes.

From May 1, 1928, to June 30, 1929, 650,000 five-grain capsules have been distributed and from July 1, 1929, to July 1, 1930, 850,000 capsules, and 600,000 capsules will have been distributed by January 1, 1931.

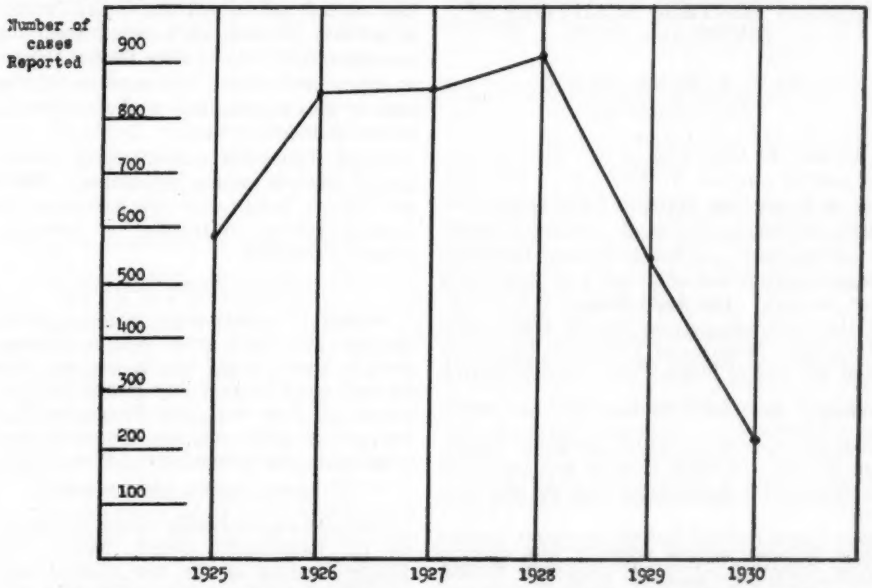
Considerable mosquito control work has been done in the incorporated towns and cities. There are only a few larger towns in the malaria district and five of these have carried out mosquito control programs with good results.

Because of economic conditions and the absence of previous educational work it has been impossible to do much toward mosquito control in the rural districts, and all that has been done is the screening and drainage that the individual tenants or landowners have undertaken. However, the educational program has brought results and much more will be done when the financial conditions permit.

It will be noted from this report that the principal work that has been done and is being done at this time toward control of malaria in Oklahoma is the education of the rural dwellers and the treatment of the already existing cases of malaria. Mosquito control work has been

Table 3

INCIDENCE OF MALARIA IN FOUR OKLAHOMA COUNTIES
Cases Reported by Physicians for the Six Year Period 1925 to 1930, Inclusive.
Control Program Started in These Counties in the Summer of 1928 and the Spring of 1929.



Note.—Cases reported in 1930 are for the first ten months of the year; however, very few cases are reported in the last two months of any year.
Counties represented are Bryan, Choctaw, Pushmataha and McIntosh.

started and it is planned to start a screening program as soon as it is possible to do so.

There has been a great reduction in malaria in the ten counties that have had the control program and additional surveys will be made to determine if possible the extent of this reduction. This year has been favorable for the reduction of malaria because of an extremely dry summer following a very hard cold winter.

The curve in *Table 3* shows the number of malaria cases in four counties that have been reported by physicians for each year over a six-year period. The malaria work was started in these counties in the summer of 1928 and spring of 1929, and it will be noted that there is a marked drop in the number of cases reported during the past two years in spite of the fact that there has been much better reporting by physicians during the past two or three years.

This drop in the number of cases reported is not due entirely to the control work, because the rainfall for this year (1930) has been much below normal, as has already been mentioned. However, we believe that the foundation for malaria control work has been laid in the State.

MALARIA CONTROL ACTIVITIES IN TENNESSEE, 1930*

By E. L. Bishop, M.D.,†
Nashville, Tenn.

This was the third year of our intensive malaria control program in Tennessee. The program, as in previous years, included surveys for malaria incidence, studies of Anopheles breeding, county-wide control measures, municipal mosquito control and supervision of impounded water projects. The State Health Department had the continued support of the Department of Preventive Medicine of Vanderbilt University and of the United States Public Health Service.

SCREENING AND MOSQUITO-PROOFING OF HOUSES

The county-wide screening program inaugurated in 1928 in Lake County was continued this year, and it is estimated that we now have about 85 per cent of the County screened, and over one-fourth of the rural houses papered with used cotton sample paper. A complete house-to-house mosquito-proofing survey has been made and is in the process of analysis. In connection with this survey, the rural houses in Lake County were all numbered and accurately located on district maps. Galvanized sheet iron plates 1x3 inches, with numerals punched on them, were used. We believe Lake County is one of the few counties in the United States to have all its rural houses numbered. We can now accurately locate our cases of communicable diseases "by address," and can positively identify and follow each house as regards screening and other mosquito-proofing.

In Shelby County the entire staff of sanitary officers was trained in the making of screen doors and in general mosquito-proofing. The extreme general drouth considerably impaired the progress of the work, but to date 335 houses have been screened and 196 houses have been papered with cotton sample paper.

Gibson County has developed a screening program this year in which local lumber merchants are to make the doors and sell them for $2.25 each. The hardware and lumber dealers have also agreed not to sell any more wire cloth larger than 16 mesh when their present supplies are exhausted. The County Health Department is urging landowners and tenants to take advantage of this cooperation of the merchants and screen their own homes.

Milan, Humboldt and Memphis have each passed house screening ordinances. The Memphis Health Department now has one of its best sanitary officers in training on screening and mosquito-proofing.

PARIS GREEN DUSTING

Studies of county-wide malaria control by dusting with Paris green were continued this year in Dyer County by the sanitary engineers of the United States Public Health Service. The results of their work will determine the feasibility of using this measure to control Anopheles breeding in the bottom-land of West Tennessee.

IMPOUNDED WATER CONTROL

The city of Cookeville raised the water level in its municipally owned power reservoir. Proper clearing of the new flooded area was carried out and a power oiling boat was con-

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*Read before National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Twenty-Fourth Annual Meeting, Louisville, Kentucky, November 11-14, 1930.

†State Health Officer.

structed to control mosquito breeding along the shore lines.

Additional clearing was done at the Rock Island reservoir of the Tennessee Electric Power Company and dusting with Paris green was also employed.

SCHOOL SURVEYS

Blood surveys of all the schools of Lake, Dyer and Lauderdale Counties were made in March of this year and again in August. All the schools in Tipton and Shelby Counties with an incidence last year of over 5 per cent were also surveyed in August as well as selected schools in Obion County. The United States Public Health Service has cooperated largely in the examination of these specimens. The results of the spring surveys showed the usual seasonal decrease over the preceding summer. The results of the summer surveys have not yet been reported.

COMMUNITY SURVEYS

Three communities in Dyer County were surveyed in June and again in September for history, spleen and blood indices and for the mosquito population of the houses. This was done to assist the Public Health Service in evaluating its work with Paris green. Similar surveys were made in four communities in Lake County in August. These showed a considerable decrease in malaria incidence which seems to be due, at least partly, to the screening campaign in Lake County. However, the unusual drought this year makes it impossible to be sure to what extent other measures may have assisted in controlling malaria.

USE OF PLASMOCHIN IN COMMUNITIES

In Lauderdale County, two projects were carried out with the use of plasmochin. In the first of these, a vigorous treatment program with quinine and plasmochin was instituted on the Henning Farm with the object of reducing the incidence of malaria to a minimum so that the previous mosquito-proofing of the houses could be properly evaluated. This work is being reported for the State Health Department in detail by Dr. Meleney. The second plasmochin project was the administration of small weekly doses of the drug to all members of an isolated community throughout the mosquito breeding season in an attempt to control malaria transmission. This program will have to be continued for one or two years before definite results can be reported.

ROADSIDE BORROW PIT CONTROL

Several years ago, upon our recommendation, the State Highway Department embodied in its specifications a clause requiring that all borrow pits on state road contracts be satisfactorily drained. This year a cooperative arrangement was made with the State Highway Department whereby a sanitary engineer of the State Health Department reports to the Highway Department the location of state highway borrow pits which need draining, and the Highway Department does the drainage work. It is believed that efficient drainage can be maintained in this way from year to year. This work is being extended to include county highways as well.

OTHER CONTROL ACTIVITIES

In municipal mosquito control, the State Health Department makes original estimates of cost where needed and makes surveys during the mosquito season for satisfactory progress of the work. Twenty-five of the larger cities and towns and a number of smaller communities did mosquito control work this year, consisting of drainage, oiling, and in a few instances, Paris green dusting.

TEXAS MALARIA CONTROL ACTIVITIES*

By J. C. ANDERSON, M.D.,†
Austin, Tex.

Mosquito control work, with special emphasis placed upon Anopheles eradication, is carried on in more than 100 incorporated cities, and the total population so protected is about one million. The work is extended yearly to new towns wherein aid and supervision are given by the field men of the Bureau of Sanitary Engineering. At the town of Jefferson, in Marion County, following flood relief work in 1930, an anti-mosquito campaign was successfully instituted. Work was extended into the country districts where it was confined to the free distribution of quinine to the farming population.

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*Read before National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Twenty-Fourth Annual Meeting, Louisville, Kentucky, November 11-14, 1930.

†State Health Officer.

The reporting of malaria cases to the Department of Health has increased in efficiency, about 200 physicians now reporting regularly. In 1929 a total of 16,103 cases were reported, and according to death certificates filed with the Bureau of Vital Statistics, malaria caused 237 deaths in Texas in 1929.

An encouraging feature of the year's events was the interest manifested by the East Texas Chamber of Commerce through its assistant manager, Mr. H. W. Stanley. A series of five conferences was held by this organization at various points in the malaria region. They were attended by local health officers and other public officials, representatives of various organizations, and business men. These conferences should do much to gain the support needed by the State Department of Health for future malaria control activities.

The State Department of Health also held conferences with the ten rural school supervisors of the State Department of Education. The conferences were concerned with the teaching of malaria facts. The supervisors agreed to encourage the rural school teachers to give at least one lesson on malaria and its control. Talks on malaria were given by members of the State Health Department at three teachers' institutes. In ten counties of east Texas more than 50,000 copies of a leaflet were delivered direct to the rural school teachers for use in teaching malaria facts.

A county nurse put on an educational campaign, combined with a malaria survey, in Gregg County. A State nurse prepared an educational display in San Jacinto County in connection with a local celebration. Malaria exhibits were displayed at the Convention of the League of Texas Municipalities, at the meeting of the Texas Medical Association, and at the Dallas State Fair.

For the first time in history, the Department was successful in getting malaria statistics published in the newspapers. A map of Texas showing the distribution of malaria was also reproduced in the papers and in the magazine of the State Teachers' Association, *The Texas Outlook*. It attracted much attention on the part of the public, and also from certain members of the Legislature who criticised us for laying bare the facts. On the other hand, the publicity drew resolutions of approval from several interested organizations.

The malaria control operations now carried on in the cities have not spread, as was hoped, to the rural sections. We have noted with apprehension lately an increase in malaria in certain rural areas of east Texas. Accordingly we are planning to ask the next Legislature for an appropriation of $30,000 to meet this very great need. We are also hoping to make some thorough investigations as to the type of work which the situation requires before making the request for funds.

MALARIA IN VIRGINIA*

By H. G. GRANT, M.D.,†
Richmond, Va.

Malaria has declined to such a low ebb in Virginia that, for the time being, it hardly constitutes a disease of any economic significance. Below are given two tables which show the trend in cases and deaths from 1921-1930, both in the cooperative counties and in the State as a whole. The cooperative counties are situated in the eastern section of the State and represent a population of 238,047.

Table 1 shows the incidence of malaria both in the cooperative counties and in the State as a whole. The number of cases reported in the cooperative counties has declined from 1,540 in 1921 to 54 through September of 1930. In the State as a whole the number of cases has declined from 3,861 in 1921 to 555 through September, 1930.

Table 2 shows the deaths from malaria both

*Read before National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Twenty-Fourth Annual Meeting, Louisville, Kentucky, November 11-14, 1930.

†Director of Malaria Control, State Board of Health.

in the cooperative counties and in the State. The deaths in the cooperative counties varied from 12 in 1921 to 1 through September, 1930, whereas the deaths in the whole State have varied from 43 in 1921 to 10 through September, 1930.

On account of the very low incidence of the disease, malaria activities have been held in abeyance for this year.

Table 1

MALARIA INCIDENCE IN COOPERATIVE COUNTIES, 1921-1930

	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930 Thru Sept.
Accomac	200	212	296*	2	2	13	10	1	0	0
Brunswick	57	93	117	57*	0	0	2	6	2	2
Greensville	242*	251	267	98	88	80	65	36	33	6
Henrico	89	70	69*	77	8	38	15	1	0	0
Isle of Wight	208	324	252	165*	109	245	54	96	57	21
Nansemond	177	168*	33	5	16	7	16	10	14	4
Norfolk County	14	5	12	4	0	0	24*	5	1	2
Northampton	226	163	254	90*	0	3	30	1	0	0
Princess Anne	154	72	71*	65	50	24	9*	7	3	4
Southampton	173	204	179	155	184	106*	19	10	14	15
Total	1540	1562	1550	718	457	516	244	173	124	54
State total	3861	3651	3611	2485	1838	1641	1413	1106	860	555

Asterisks indicate the year health work started in county.

Table 2

MALARIA DEATHS IN COOPERATIVE COUNTIES, 1921-1930

	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930 Thru Sept.
Accomac	1	1	0	0	0	0	0	0	2	0
Brunswick	0	1	1	0	0	0	0	0	1	0
Greensville	2	2	0	1	1	2	0	0	0	0
Henrico	0	0	0	0	0	0	0	0	0	0
Isle of Wight	1	2	3	2	0	0	0	0	1	0
Nansemond	2	10	9	5	6	2	1	0	0	0
Norfolk County	1	4	3	2	3	1	2	1	0	0
Northampton	0	0	1	0	0	1	0	0	0	0
Princess Anne	3	2	0	0	2	0	0	1	2	0
Southampton	2	0	1	3	2	2	1	0	0	1
Total	12	22	18	13	14	8	4	2	6	1
State total	43	41	45	35	45	25	23	13	16	10

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EDITORIAL DEPARTMENT

SOUTHERN MEDICAL ASSOCIATION
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INCIDENCE OF MALARIA

Physicians will freely admit that in the past malaria diagnoses have frequently been employed with insufficient precision or even carelessness. The diagnosis should signify infection with one of the three species of human plasmodia, in many cases only determinable by microscopic examination of the patient's blood. In no case should its use be a confession of inability to arrive at a more precise estimate of the symptoms. With the ample public and private facilities now available in every Southern state for the detection of the parasites, no physician can convincingly plead lack of personal competency or facilities as an excuse for failure to make his employment of this term precise.

Inattention to the question of diagnosis is responsible for the lack of esteem in which morbidity and mortality statistics of malaria are commonly held. The removal of malaria from the list of the public health problems of the South is too important a consideration to be clouded or befogged by carelessness and inaccuracy. Accurate morbidity reporting of individual cases of malaria gives to local health departments indispensable facts which reveal the foci that should command the attention of the departmental staff. It is believed by many authorities on the subject that the time is now ripe for state boards of health to require the reporting of malaria cases individually, by name and place of residence.

Facts relating to malaria do not hurt the South, as they afford a secure basis for the organization and execution of control work. Facts are difficult to obtain. Fiction, which unfortunately has had a large place in malarial statistics, does damage. The truth cannot be distinguished by those inclined to be discriminatory, nor can fiction serve as a basis for practical control. The South is willing both to face and deal with the actual malaria problem. If this is revealed by facts, the frank attitude will result in the early elimination of the problem. If the situation is obscured by inaccuracies, no amount of frankness can accomplish this result.

The National Malaria Committee, meeting for many years conjointly with the Southern Medical Association, has annually reported its intensive studies on the diagnosis, control from a public health standpoint, and specific treatment of malaria. These papers have been important in what has been, it is hoped, a continuous reduction of the incidence of this disease. This month the JOURNAL contains again the accounts of the Committee's attempts and achievements during the past year. The reports are not limited to the work done in the Southern states, but describe methods used in Italy, Haiti, and all parts of the world. Among other subjects, the use of plasmochin in malaria is again evaluated. The reports will be of great interest and value to those acquainted with the malaria problem of this section of the country, and equally to students of malaria on other continents and islands, in the Western and Eastern Hemispheres.

GOITER AND INTELLIGENCE

The physiology of mind is a subject upon which all scientific discoveries in some way bear. The mind is the evolutionary peak, resting on every type of enrichment of physiological reaction which has developed in a million years of life. Psychological studies of mental deficiency have been in only a few instances correlated with physiological findings; though the buoyant still have hope, but no immediate expectation, of diagnosing insanity and feeble-mindedness by blood clinical or serological examinations, or by stethoscope or x-ray.

The relationship of goiter and mental deterioration, however, was recognized in Europe many years ago. The cretin has a fixed low mentality. Even when recognized and treated early he has a predestined mental age of six to eight years; and though his bodily development may be stimulated by early specific treatment, he does not develop mentally beyond this age. His whole physical development is limited, according to Kimball and Marinus,[1] by an abnormal vascular system which becomes fixed in intrauterine life, and which limits the functional growth of the cortical areas of the brain.

To illustrate the effect of goiter on capillary development, a number of studies of the circulatory system of cretins have been made. Particularly the capillaries of the nail bed have been examined, and the picture which they give has been used by certain physicians as diagnostic of congenital hypothyroidism in the absence of pronounced clinical signs.

The teachability of a child, says Eisendrath,[1] after examining 3,100 feeble-minded children, runs parallel with the development of his capillaries.

In Detroit, as in most other public school systems in large cities throughout the country, for a number of years classes have been maintained for the mentally deficient child to separate him from the child of average ability. Since goiter is endemic in the Detroit district, it was attempted to discover the relationship of its incidence to the mental development of the children.

Kimball and Marinus examined 3,548 mentally subnormal school children, 281 of whom showed evidence of congenital hypothyroidism. Eight per cent, thus, of all the mental defectives of the Detroit public schools had suffered from endemic goiter. If other statistics are included, these workers say, 10 per cent of all feeble-mindedness is associated with goiter, which is in turn the result of maternal hypothyroidism during fetal life. This is a comparatively small proportion when one considers how current is the belief that thyroid function is intimately concerned with intellectual power.

Of the defectives examined, about half showed some mental growth throughout the period of observation. Their intellectual powers increased with age, although at a retarded rate. They experienced a continuous but slow mental development, had a constant intelligence quotient which was always below normal. In another group, the development reached a fixed level and did not increase with age. These had, therefore, a falling intelligence quotient. They were the more hopeless cases. Eighty per cent of those with falling intelligence quotient were in the congenital goiter group.

The city of Detroit, say Kimball and Marinus, is paying forty thousand dollars per year to educate those made defective by thyroid disease; and the education which they can take is of course very limited. By preventive measures applied in school, the incidence of goiter in the schools was reduced from 42 to 7 per cent between the five-year period from 1924 to 1929.

In pregnancy, therefore, one must reason, the obstetrician should pay constant attention to the thyroid of his patient as a preventive measure, and the iodine intake should be particularly observed. This is one of the most important phases of prenatal care. Where conven-

1. Kimball, O. P.; and Marinus, J. C.: Relation of Endemic Goiter to Mental Deficiency. Ann. Int. Med., 4:509, Dec., 1930.

ient, basal metabolism determinations can be used to great advantage during pregnancy. It is said that if after the fifth month of gestation the metabolism of the mother does not rise, the child is destined to be a cretin.[2]

This particular type of mental deficiency is distinctly a medical and public health problem, one in which state and particularly school boards of health should be interested.

Many persons have thoughtlessly assumed that individuals of the hyperthyroid diathesis were mentally abler and more alert than those of the hypothyroid status. This is wholly incorrect. Thyroid tissue in these studies was necessary for continuous mental development, but mental retardation was in no way proportional to thyroid activity. A number of other causes obviously are active in producing a normal mind. Cretinism is merely one of the severest stages of mental deficiency which is compatible with life.

DIET IN ARSPHENAMINE REACTIONS

The difficulty of administering sufficient bactericidal substance to kill bacterial cells without killing host cells is of course the outstanding problem in treatment of parasitic diseases. Without the patient, syphilis could be cured in no time. Methods of increasing the host's resistance are to be sought, as much as drugs of lessened toxicity, and toxicity is at all times a relative thing. The susceptibility of the host is constantly changing.

Quinine-fast malaria, it is said, does not occur because the plasmodium has become resistant to quinine, but because the host's resistance is lowered. It is doubtless as important to use all possible general measures of increasing the resistance of the host in syphilis as it is to administer arsenic. Dietary adjuvants to antiluetic therapy can considerably influence the effectiveness of the arsenicals in destroying the spirochete.

2. Abbott, A. C.; and Ball, R. O.: Pathology of Thyroid Gland of Human Fetus and New Born Infant. Ca. Med. Ass'n. Jour., 24:347, March, 1931.

Central necrosis of the liver is a lesion observed following deaths after the administration of arsenic and chloroform. The resistance of the liver to poisons seems to be dependent not merely upon the type of liver with which the patient grows to adult life, but it changes almost from day to day with food consumption. The resistance of the liver is peculiarly variable under different diets, and following certain forms of feeding during merely a few days, its sensitivity to several poisons is exaggerated.

Carbon tetrachloride, for example, is one of the drugs employed to rid the intestines of parasites. Deaths are occasionally reported following its clinical use in small doses. Minot[3] showed that dogs fed either a high carbohydrate or a high protein diet were particularly sensitive to carbon tetrachloride poisoning. Dogs on either straight meat or straight bread diets frequently succumbed to small doses of the drug and showed the picture of fatty infiltration of the liver. Dogs which were fed both meat and bones, or both bread and milk, seldom died after administration of carbon tetrachloride. Lamson believed that the calcium of bones or milk exerted a protective action upon the liver, and he has produced further evidence to support this point.

Craven,[4] at the Johns Hopkins Hospital, has studied the effects of arsphenamine upon dogs on three types of diet: a high carbohydrate diet consisting chiefly of rice and white bread; a high protein diet, of lean meat; and a diet high in animal fat.

The ten animals of the high carbohydrate series were manifestly the most susceptible to the injurious effects of medication. All of them showed some central liver necrosis, which was severe in half the animals. Of the livers of the dogs on high protein, after the same quantity of arsenic, about half showed no injury. The remainder of the protein group had only

3. Minot, A. S.: Relation of Calcium to Toxicity of Carbon Tetrachloride in Dogs. Proc. Soc. Exper. Biol. and Med., 24:617, 1927.

4. Craven, E. B., Jr.: The Importance of Diet in Preventing Acute Yellow Atrophy During Arsphenamine Treatment. Bull. Johns Hop. Hosp., 48:131, March, 1931.

slight liver damage. Of the last group, those on high fat, only one showed any necrosis of the liver.

Carbohydrate is the cheapest food which produces the sensation of satiety. It is the chief dependence of many families. It is advocated, on perhaps wholly inadequate grounds, in the toxemia of pregnancy. Craven's diets were of course extreme. One would not expect the average individual to subsist strictly on any one of them, and none of the three would be in any way desirable for maintenance over even a few weeks. One would be more inclined, in view of Lamson's evidence of the protective value of calcium against another injurious drug, to advocate consumption of milk or considerable quantities of fruit juices during a series of arsenic injections, accepting Craven's hint that high carbohydrate consumption during arsphenamine courses is dangerous. The patient under antisyphilitic therapy should be particularly warned against the strictly carbohydrate, white rice, white flour diet which is apt to be the mainstay of the nutritional habit of the poor.

Book Reviews

An Introduction to Malariology. By Mark F. Boyd, M.D. 437 pages with illustrations. Cambridge, Mass.: Harvard University Press, 1930. Cloth, $5.00.

Malaria workers throughout the world will appreciate Dr. Boyd's book, "An Introduction to Malariology." To the young student it gives the basic information on malaria concisely. To the experienced malariologist, the discussions of methods of procedure and the analysis of data are invaluable.

Dr. Boyd's book commences with a brief history and, fortunately, a not so brief natural history of malaria. It includes a discussion of the mode of infection and results. The essential habits of mosquitoes in relation to the transmission of malaria are described so clearly that after a brief study of the mosquito fauna of any given place one could predict the probable malaria vector. The student is instructed in the proper method of making a malaria survey. The essential data are indicated with methods for collection and analysis. Anopheline surveys are described and accompanied by discussions on the food of larvae, flight of the adult anophelines and their habits. The types of breeding place chosen by different species are described and the probable shelters for roosting adults are enumerated. In these descriptions Dr. Boyd has not confined himself to any one country or species of Anopheles. The examples given embrace nearly every section of the globe and are beautifully chosen as illustrations of the principles under discussion. The collection and preservation of material receive detailed comment and there is included a brief description of the biology of the mosquito, its anatomical structure, and methods for dissection. It is evidently Dr. Boyd's intention to refrain from presenting any detailed consideration of the various types of control work and their method of application, yet he gives an excellent brief discussion of the relation of surveys to malaria control. He has succeeded in so clearly presenting the principles upon which malaria control rest that he gives the control worker a sure guide for the solution of his problem. The book is well illustrated with carefully chosen photographs and charts. Each chapter is followed by a comprehensive list of references and the book ends with a well selected bibliography of general reading on malaria and its control.

Malariologists have heretofore been unable to refer the new student to any one source of information which would give him a comprehensive view of malaria and its measurement, mosquitoes and their habits, and the general principles of control, without confusing him with too great a mass of detail. Dr. Boyd's work satisfies this need and provides the experienced malariologist with a valuable reference book.

Clinical Allergy, Particularly Asthma and Hay Fever; Mechanism and Treatment. By Francis M. Rackermann, M.D., Physician to the Massachusetts General Hospital, Instructor in Medicine, Harvard Medical School, Boston, Mass. 617 pages with illustrations. New York: The Macmillan Company, 1931. Cloth, $10.50.

This is the most thorough and complete work on this subject with which this reviewer is familiar. The material is carefully chosen and well arranged. The size of the type and character of the paper facilitate reading. The extensive bibliographies at the ends of the chapters are alone worth the price of the book. This work will prove useful not only to the immunologist as a reference book, but also to any physician wishing to acquaint himself with the present knowledge in this field which is growing rapidly in importance.

Microbiology and Elementary Pathology. For the Use of Nurses. By Charles G. Sinclair, B.S., M.D., Major, Medical Corps, U. S. Army. With 102 illustrations, some in colors. 356 pages. Philadelphia: F. A. Davis Company, 1931. Cloth, $2.50.

Sinclair has covered the field in this excellent book for nurses. The discussions, while brief, are much more complete than in the usual text of this kind. Bacteriology is covered in twenty-three lectures and pathology in eight. Since it is written from the standpoint of the nurse, the vocabulary is simple, the illustrations and printing are very good and the addition of laboratory exercises completes the book.

Abnormal Psychology: Its Concepts and Theories. By H. L. Hollingworth, Ph.D., Professor of Psychology, Bernard College, Columbia University. Psychology Series by Albert T. Poffenberger, Ph.D., Editor, Professor of Psychology, Columbia University. 590 pages. New York: The Ronald Press Company, 1930. Cloth, $4.50.

The method of presentation of the concepts of abnormal psychology is unique. "In this volume an effort is made to feature the systematic aspects rather than the expediencies."

The mental processes, normal and abnormal, are considered. The contemporary viewpoints of mental aberrations are thoroughly examined and evaluated. The author makes his approach to the problem from the viewpoint of the normal, considering the abnormalities as the deviations. He contends that the normal rather than the abnormal demands explanation.

A study of the different personalities is made. Then the deviations found in these personalities in the psychoneuroses of different types are studied. The case studies, from the author's own records and borrowed from other workers, are appropriate and illustrative. The comparative deductions are valuable to the student.

The student of psychology, the clinician, and those interested in everyday practical psychology, will find this sane and interesting approach to the subject very stimulating.

Modern Surgery. By John Chalmers DaCosta, M.D., LL.D., F.A.C.S., Samuel D. Gross Professor of Surgery, Jefferson Medical College, Philadelphia. Assisted by Benjamin Lipshutz, M.D., F.A.C.S., Surgeon to the Mt. Sinai Hospital. 1404 pages with 1050 illustrations, some in colors. Philadelphia: W. B. Saunders Company, 1931. Cloth, $10.00.

In this tenth edition the section by Dr. Chevalier Jackson on laryngoscopy is the only one that has not been revised. The chapters on x-ray and radium have been omitted, the reader being referred to separate treatises. The injection treatment of varicosities has been added. Surgical technic of the respiratory system, abdomen and tuberculosis has been brought up-to-date. Throughout the book the superfluous illustrations have been removed, the best from war surgery has been retained and the verbiage has been made simpler and clearer. As a single volume surgical text it is practical and complete.

Pye's Surgical Handicraft: A Manual of Surgical Manipulations, Minor Surgery, and Other Matters Connected with the Work of House Surgeons and Surgical Dressers. Edited by H. W. Carson, F.R.C.S. (Eng.), Late Senior Surgeon, Prince of Wales General Hospital, Tottenham. Tenth edition; fully revised. 641 pages with some additional matter and illustrations. New York: William Wood & Co., 1931. Cloth, $7.00.

For almost fifty years this text of surgical handicraft has been a guide for house surgeons and dressers. Dr. Herbert Carson has completely revised this volume, which will probably be his last contribution to medical literature. A section on venereal diseases has been added, as have chapters on the radium treatment of cancer. The book has been further augmented by sections covering infected wounds of the hand, the injection treatment of varices, tannic acid treatment of burns and Thiersch's method of skin grafting. The chapter on roentgen diagnosis and treatment has been improved and a discussion of avertin is included in the chapter on anesthesia. The discussion on diseases of the teeth has been retained and should prove valuable to the lone practitioner. The younger surgeon will find the book useful, though brief.

Surgical Emergencies in Practice. By W. H. C. Romanis, M.A., M.B., M.Ch. (Cantab.), F.R.C.S. (Eng.), F.R.S. (Edin.), Surgeon to and Lecturer in Surgery at St. Thomas's Hospital, and Philip H. Mitchiner, M.D., M.S. (Lond.), F.R.C.S. (Eng.), Surgeon in Charge of Out-Patients, St. Thomas's Hospital. 608 pages with 158 illustrations. New York: William Wood & Co., 1931. Cloth, $6.00.

The authors take up all the medical and surgical conditions in which active treatment within forty-eight hours is required, which is rather a broad field, and hence the title is misleading. The usual methods of treatment are given, necessarily briefly. The care and operative technic of peritonsillar abscess is very well carried out. No mention of morphine as a preoperative agent of analgesia is made. The use of ephedrine in acute sinusitis is not discussed. Many little points such as eating bulky foods in cases where a fish bone is stuck in the esophagus, sewing the gums together in hemorrhage following extraction of teeth and local anesthesia in paracentesis of the ear are ignored. The writers advise laparotomy and the squeezing of the pus from the tubes in cases of acute salpingitis. This book cannot be recommended.

Laboratory Medicine. By Daniel Nicholson, M.D., Member of the Royal College of Physicians, London; Assistant Professor of Pathology, University of Manitoba; Assistant in Pathology, Winnipeg General Hospital. 437 pages with 108 engravings and a colored plate. Philadelphia: Lea & Febiger, 1930. Price, cloth, $6.00.

A new book of laboratory procedures is needed by the physician, as well as the pathologist, at frequent intervals because of the continuous advances in laboratory technic. The results of tests are better interpreted by persons familiar with their technic.

This volume contains good descriptions of most of the divisions of laboratory medicine. The sections on morphology of the blood are good. They describe clearly the methods of examination of red and white cells of recent popularity.

The sections on blood chemistry are not so clear, complete or convenient as those of some American texts. The descriptions of methods of blood culture are very brief. The bacteriological and serological parts of the volume in general are brief and inadequate. For diagnosis of syphilis only the Wassermann reaction is mentioned. Serological tests for undulant fever and tularemia are not mentioned.

The book will be very useful for those who have several volumes of laboratory medicine.

Physical Diagnosis. By Warren P. Elmer, B.S., M.D., Associate Professor of Clinical Medicine, Washington University School of Medicine; Late Associate Professor of Medicine in the University of Arkansas, Little Rock, Arkansas. 903 pages with 337 illustrations. St. Louis: The C. V. Mosby Company. Price, cloth, $10.00.

Dr. Elmer undertook the revision of this text with the understanding that the publishers would allow him absolute freedom in the work. A great deal of the original material has been retained, large portions verbatim, and a number of additions have been made. The most outstanding change is the rearrangement of the presentation. A more orderly procedure is the result, as each diagnostic procedure is fully discussed and applied to the whole body before the introduction of the next step. The first section covers the technic of physical examination. The second takes up diseases of the respiratory and circulatory systems. New illustrations have been inserted, especially roentgenograms and electrocardiograms, though most of the pictures have been retained from earlier editions.

The Clinical Interpretation of Blood Examinations. By Robert A. Kilduffe, A.B., A.M., M.D., F.A.S.C.P., Director of Laboratories, Atlantic City Hospital. 629 pages illustrated with 60 engravings. Philadelphia: Lea & Febiger, 1931. Cloth, $6.50.

Dr. Kilduffe has thoroughly covered the entire field of blood examination in this exhaustive treatise. Each component of the blood is fully discussed. All the more recent tests are included, even those of questionable or unproved value, so that the reader may gain an idea of the reliability and the advantages of each laboratory procedure. If the physician is interested in the technical and manipulative methods involved, these are detailed minutely. The greatest stress is placed upon interpretation and the evaluation of the blood findings, the author holding the view that correct diagnosis is the ultimo. The book is a good one.

Deformitaten und kosmetische Operationen der weiblichen Brust. By von Dr. Hermann Biesenberger, Oberarzt des Roten-Kreuz-Spitales Rudolfinerhaus in Wien. 209 pages with illustrations. Wien, Germany: Verlag von Wilhelm Maudrich, 1931.

The cosmetic urge impels the not-so-young woman to have her face lifted, and now likewise to have her bust lifted. Also she is impelled to have deformities of the bust corrected. Reducing the size of the busts, removal of unsightly, deforming scars, correction of asymmetry, correction of hypertrophy of the busts, correction of fat pendulous busts, improvement of fixation of breasts, and other such operations are now being done more and more, especially in Europe.

This well-written, profusely illustrated monograph by Beisenberger gives the technic and results for the various operations now in use. The essential steps in the different operations are so well shown in cuts that they can be well understood without reading the text.

A bibliography of sixty-one original papers is appended. All the articles are by German authors except two, which are in French. Nearly all are of very recent date.

The book in a highly specialized field is good.

Southern Medical News

The Scientific Session of the American Heart Association will be held at Philadelphia Tuesday, June 9, 1931, from 10 a. m. to 5 p. m., in the Main Surgical Clinic of the Pennsylvania Hospital at Eighth and Spruce Streets.

ALABAMA

Dr. A. C. Jackson, Jasper, was recently elected President of the Jasper Rotary Club. Dr. Jackson is President of the Walker County Hospital.

Dr. William Sydney Thayer, Baltimore, Emeritus Professor of Medicine, Johns Hopkins, was the guest of the Birmingham Clinical Club at its banquet in April, at which time he spoke on "Bacterial Endocarditis."

Dr. Louis J. Hirschman, Detroit, addressed the Jefferson County Medical Society, Birmingham, at a meeting recently. While in Birmingham he held clinics at the Hillman Hospital.

Alabama hospitals are planning to have open house on May 12 in observance of National Hospital Day.

Birmingham's Medical Arts Building, under construction, will be ready for occupancy probably about October 1. It is situated at Five Points, South.

Dr. Thomas L. Bennett, Jr., and Miss Mildred Jackson, both of Florence, were married February 17.

Dr. Arthur H. Graham, Opelika, and Miss Henrie Elma Gholson were married February 21.

Deaths

Dr. Julius Jones, Rockford, aged 72, died February 12 of endocarditis and nephritis.

Dr. William Preston Copeland, Eufaula, aged 85, died February 17.

Dr. Walter Homer Holliday, Birmingham, aged 63, died March 4.

Dr. Leonard Rice Stone, Taff, aged 70, died February 13.

ARKANSAS

The Searcy County Medical Society has elected the following officers for 1931: Dr. George W. Dickens, Leslie, President; Dr. E. G. Fendley, Leslie, Vice-President; and Dr. Sam G. Daniel, Marshall, Secretary-Treasurer.

The Hot Springs County Medical Society has elected Dr. E. T. Bramlitt, Malvern, President; Dr. J. M. Williams, Malvern, Vice-President; and Dr. W. G. Hodges, Malvern, Secretary-Treasurer.

At a recent meeting of the Mississippi, Arkansas and Tennessee Tri-States Medical Association, Dr. L. H. McDaniel, Tyronza, was elected President of the Association.

Dr. J. P. Sheppard, Little Rock, has been appointed to succeed the late Dr. J. P. Runyan as district and hospital surgeon for the Rock Island Lines. Other physicians included on the Surgical Staff are Dr. J. I. Scarborough and Dr. M. D. Ogden.

Dr. Daniel R. Hardeman, formerly of Little Rock, and son of the late Dr. D. R. Hardeman, Little Rock, and Miss Ruth Burbank were married February 14.

Deaths

Dr. James Yates Smith, Sparkman, aged 59, died December 27.

Dr. Phebe Lininger, Springdale, aged 77, died February 5 of cerebral hemorrhage.

Dr. B. F. Hancock, Nashville, aged 76, died of heart disease January 20.

DISTRICT OF COLUMBIA

Deaths

Dr. Ernest Wellington Smith, Washington, aged 50, was killed in an automobile accident February 1.

Dr. James Clark McGuire, Washington, aged 78, died January 21.

FLORIDA

The Putnam County Medical Society has elected officers for 1931 as follows: Dr. W. S. Miller, Palatka,

President; Dr. E. W. Ford, Crescent City, Vice-President; and Dr. E. W. Warren, Palatka, Secretary-Treasurer.

Dr. L. W. Glatzau, DeLand, has moved to Jacksonville, where he has opened offices in the Professional Building.

Dr. William H. Daniels, of the University of Maryland, has recently located in Miami.

Dr. Donald Babcock has moved from Miami to Los Angeles, California.

Dr. William B. Clark has moved from Ocala to New Orleans, Louisiana.

Dr. W. C. Young, Jr., has moved from Waldo to Canal Point.

Dr. L. J. Arnold, Lake City, has just returned home from Washington, where he spent some time in post-graduate work in the U. S. Diagnostic Center.

Dr. Alvyn White is now practising pediatrics at Pensacola.

Deaths

Dr. V. M. Jared, West Palm Beach, died February 22 following an operation for acute appendicitis.

Dr. William C. Dewberry, Pensacola, aged 64, died January 25 of pneumonia.

GEORGIA

Dr. Frank K. Boland, Atlanta, has been appointed a member of the Council from Georgia of the Southern Medical Association, the appointment having been announced recently by the President, Dr. Felix J. Underwood, Jackson, Mississippi. Dr. Boland succeeds Dr. W. P. Harbin, Rome, whose term has expired, and having served the constitutional limit, was not eligible for reappointment.

The Davis-Fischer Sanatorium, Atlanta, has been changed to the Crawford W. Long Memorial Hospital and Clinic, and a bronze tablet of Dr. Long was placed on the front of the building. This event took place on March 30, 1931, the 89th anniversary of the discovery of ether anesthesia by Dr. Long. Addresses were made by the Governor, the Mayor, and others.

The School of Medicine of Emory University, Atlanta, has been presented with an oil portrait of Dr. E. C. Davis, founder of Base Hospital No. 43, A. E. F., by the surviving members of the hospital staff.

The following county societies are on the honor roll for 1931 for having all of their eligible physicians members of their county societies: Randolph County, Butts County, and Monroe County.

Emory University is making plans for its annual alumni clinic week to be held in connection with Emory University School of Medicine June 8 to 12.

Bullock-Candler-Evans Counties Medical Society has elected the following officers for 1931: Dr. W. D. Kennedy, Metter, President; Dr. W. D. Woods, Portal, Vice-President; and Dr. W. E. Simmons, Metter, Secretary-Treasurer.

Elbert County Medical Society has elected the following officers for 1931: Dr. A. S. J. Stovall, Elberton, President; Dr. W. A. Johnson, Bowman, Vice-President; and Dr. Guy C. Hewell, Dewey Rose, Secretary-Treasurer.

Officers for the Monroe County Medical Society for 1931 are Dr. W. J. Smith, Juliette, President; Dr. J. O. Elrod, Forsyth, Vice-President; and Dr. G. H. Alexander, Forsyth, Secretary-Treasurer.

Cobb County Medical Society has elected the following officers for 1931: Dr. R. W. Fowler, Marietta, President; Dr. C. W. Burtz, Acworth, Vice-President; and Dr. G. F. Hagood, Marietta, Secretary-Treasurer.

Fulton County Medical Society has elected the following officers for 1931: Dr. T. C. Davison, Atlanta, President; Dr. William A. Smith, Atlanta, Vice-President; and Dr. Howard Hailey, Atlanta, Secretary-Treasurer.

Ben Hill County Medical Society has elected the following officers for 1931: Dr. Aubrey Harper, Wray, President; Dr. Ralph E. Russell, Fitzgerald, Vice-President; and Dr. L. S. Osborne, Fitzgerald, Secretary-Treasurer.

Madison County Medical Society has elected Dr. George W. Kelley, Carlton, President; Dr. R. J. Westbrook, Ila, Vice-President; and Dr. W. D. Gholston, Danielsville, Secretary-Treasurer.

Telfair County Medical Society has elected Dr. D. W. F. Maloy, Milan, President; and Dr. W. H. Born, McRae, Vice-President.

Ocmulgee Medical Society has elected Dr. J. M. Smith, Cochran, President; and Dr. W. H. Pirkle, Cochran, Vice-President.

Carroll County Medical Society has elected Dr. L. E. Wilson, Bowdon, President; Dr. D. S. Reese, Carrollton, Vice-President; and Dr. H. J. Goodwyn, Carrollton, Secretary-Treasurer.

Taliaferro County Medical Society has elected Dr. T. C. Nash, Philomath, President; and Dr. John S. Rhodes, Crawfordville, Secretary-Treasurer.

Grady County Medical Society has elected Dr. Eugene Clower, Cairo, President; Dr. W. R. Moore, Cairo, Vice-President; and Dr. J. V. Rogers, Cairo, Secretary-Treasurer.

Glynn County Medical Society has elected Dr. H. L. Akridge, Brunswick, President; Dr. H. M. Branham, Brunswick, Vice-President; and Dr. F. N. Aldrich, Brunswick, Secretary-Treasurer.

Dr. E. B. Neal, Douglas, is doing post-graduate work at the Grady Hospital, Atlanta.

Announcement is made by Dr. T. F. Abercrombie, Atlanta, State Health Commissioner, that there are now three full-time health units operating in the drouth-stricken areas of the State and supported by the drouth relief funds of the Federal Government.

Dr. S. A. Boland has moved from Thomson to Jefferson.

Deaths

Dr. James C. Watts, Rome, aged 71, died February 3.

Dr. Thomas Lovick Nolan, Marietta, aged 28, was lost at sea January 16, while serving as ship's surgeon on his initial trip.

Dr. Hugh Angus Macaulay, Waynesboro, aged 45, died February 4 of pneumonia.

Dr. W. F. McCurdy, Weston, aged 71, died of pneumonia February 6.

Dr. Samuel Joseph Chesnut, Bainbridge, aged 68, died February 10.

Dr. George Luther Loden, Colbert, aged 43, died February 13 after several months' illness.

Dr. Edward Campbell Davis, Atlanta, aged 63, died March 11 of pneumonia.

Dr. Albert Lee Franklin, Atlanta, aged 61, died January 15.

Dr. Sophia C. Davis, Augusta, aged 80, died January 16.

KENTUCKY

At a recent meeting of the Franklin County Medical Society a resolution was passed by the Society endorsing the erection of a new building on a new site for the King's Daughters' Hospital, using for this purpose a bequest of $25,000 which came to the Hospital recently.

Bourbon County Medical Society has elected the following officers for 1931: Dr. J. A. Orr, Paris, President; Dr. J. S. Wallingford, Paris, First Vice-President; Dr. H. M. Boxley, Millersburg, Second Vice-President; and Dr. M. J. Stern, Paris, Secretary-Treasurer.

Deaths

Dr. Walter Brooks Hughes, Newport, aged 38, died February 6 of influenza.

Dr. Thomas A. Cook, Democrat, aged 65, died January 30 of appendicitis.

Dr. William A. Horton, Grayson, aged 64, died February 18 of pneumonia.

LOUISIANA

The twenty-sixth annual meeting of the Tri-States Medical Society, Louisiana-Arkansas-Texas, was held at Shreveport March 19-20, 1931.

Announcement is made that contract has been awarded for the immediate construction of the new Flint-Goodridge Hospital, New Orleans, a unit of the Dillard Memorial University. This hospital will be for the negroes.

Contract has been awarded and construction started on the nine-story Medical School Building of the Louisiana State University on the grounds of Charity Hospital, New Orleans.

The Fourth District Medical Society held its annual meeting in March at State Charity Hospital and elected the following officers: Dr. W. B. Hunter, Coushatta, President; Dr. O. C. Rigby, Shreveport, First Vice-President; Dr. Guy A. Caldwell, Shreveport, Sec-

Continued on page 34

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*Hess, A. F., and Weinstock, M., and Rivkin, H.: Proc. Soc. Exper. Biol. and Med., 27:665, April, 1930.

**Barnes, D. J., Brady, M. J., and James, E. M., Amer. Jour. Diseases of Children, Vol. 39, No. 1, January, 1930, page 58.

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Continued from page 470

ond Vice-President; and Dr. W. B. Heidorn, Shreveport, Secretary-Treasurer.

Dr. Elias Weiner, Alexandria, and Miss Pauline Mossoff were married March 8 in Brooklyn, New York.

Deaths

Dr. Alexander Ledoux, New Orleans, aged 61, died December 23.

MARYLAND

Dr. Harry Goldman, Associate Obstetrician of the Sinai Hospital, Baltimore, recently gave a series of radio talks on Pre-Natal Care under the auspices of the Maternal and Child Welfare Association over Station WCBM.

Deaths

Dr. Edgar Shirley Perkins, Baltimore, aged 58, died March 7 of heart disease.

Dr. John Conrad Hemmeter, Baltimore, aged 67, died February 27.

Dr. George L. Fox, Linden, aged 74, died January 14.

Dr. Samuel T. Earle, Jr., Baltimore, aged 82, died February 19 in the Union Memorial Hospital of angina pectoris.

Dr. Edwin Brown Claybrook, Cumberland, aged 59, died February 28.

MISSISSIPPI

Dr. P. L. Fite, Columbus, Superintendent of Fite Hospital, is enlarging his hospital, having added ten new rooms to the building, and in other ways improving the place.

Dr. J. W. Lipscomb, Jr., Columbus, son of the President of the State Board of Health, has been appointed a member of the staff of the Memorial Hospital, New York City, effective July 1. Dr. Lipscomb is now connected with the McLeod Hospital, Florence, South Carolina.

Dr. M. J. Few, Rolling Fork, and Miss Jennie McCuiston were married March 8 at Glen Ellen.

Deaths

Dr. R. H. Stewart, Poplarville, died March 16.

Dr. J. S. Adams, Sumrall, aged 52, died February 5 of pneumonia following accidental burns.

Dr. William G. Dorroh, Madison, aged 60, died February 5 of cerebral apoplexy.

Dr. J. P. O'Leary, Vicksburg, aged 61, died February 23.

Dr. Reese S. Wooley, McCall's Creek, aged 60, died February 2 at Natchez of arteriosclerosis.

Dr. W. L. Hugston, Ethel, aged 63, died February 27.

Dr. William Granville Sykes, Aberdeen, aged 85, died January 18.

MISSOURI

The Kansas City Southwest Clinical Society held its regular monthly hospital clinic in April at the Children's Mercy Hospital, Kansas City.

The Department of Justice has selected Springfield as the location for the new $2,500,000 Federal hospital for the criminal insane.

Dr. John R. Caulk, St. Louis, was a guest of the Philadelphia Urological Society in February, where he delivered the first of the B. A. Thomas Urological Lectures before the Society.

Dr. G. Kenneth Coonse, Columbia, Orthopedic Surgeon in charge of the State Crippled Children's Service of the University of Missouri, reports that in 1930 eight hundred and forty-one Missouri children suffering from various deformities were treated by this Service.

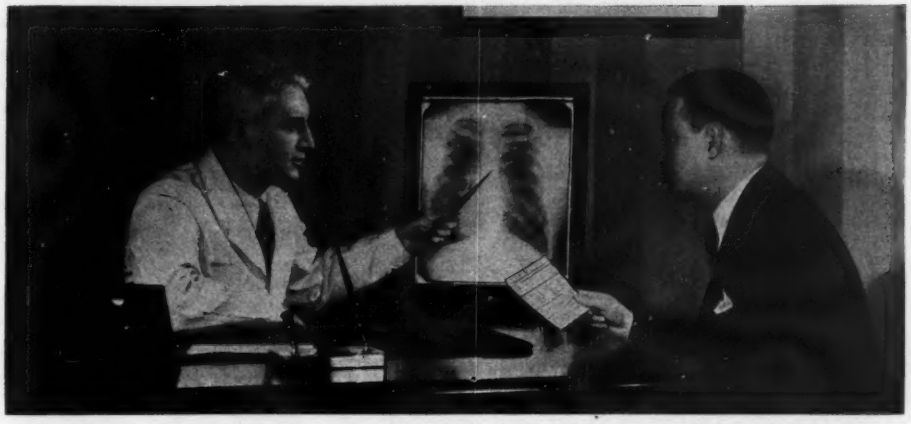
The Missouri State Medical Association will hold its annual session at Joplin May 11 to 14. The Conner Hotel will be general headquarters.

Deaths

Dr. Walter Scott Rutherford, Sullivan, aged 60, died December, 1930.

Dr. John C. Lebrecht, St. Louis, aged 71, died March 23 of heart disease.

Continued on page 36



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MANY of the nation's leading cooking authorities use sugar to season meat and vegetable dishes. The basic rule they follow is a dash of sugar to a pinch of salt.
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By improving the taste-appeal of these essential foods you will find that there will be a greater desire to eat the quantity the system needs. Most foods are more delicious and nourishing with sugar. The Sugar Institute, 129 Front Street, New York.
"Good food promotes good health"

Continued from page 34

Dr. Claude L. Sellers, St. Louis, aged 47, died March 21.

Dr. George Richter, St. Louis, aged 78, died March 12 of cerebral hemorrhage.

Dr. John P. Clark, Perryville, aged 81, died January 22 of chronic myocarditis.

Dr. Joseph Kennett Cole, Lamar, aged 79, died February 2 of pneumonia.

Dr. George Andrew King, Kansas City, aged 53, died January 29 of cirrhosis of the liver and myocarditis.

Dr. Carl Orth, St. Louis, aged 67, died February 15 of pneumonia.

Dr. Marcus M. Rhoades, Graham, aged 90, died January 16 of arteriosclerosis.

Dr. Henry Alston Killion, Portageville, aged 49, died in February.

NORTH CAROLINA

The Duke University School of Medicine and the Duke Hospital, Durham, was dedicated Monday, April 20.

The following were elected officers of the newly organized North Carolina Radiology Society: Dr. J. K. Pepper, Winston-Salem, President; Dr. W. T. Rainey, Fayetteville, Vice-President; and Dr. Major I. Fleming, Rocky Mount, Secretary-Treasurer.

Deaths

Dr. Henry Harrison Briggs, Asheville, aged 59, died February 6 while at sea.

Dr. Frederick Albert Bardwell, Oteen, aged 66, died February 15 of coronary thrombosis.

Dr. John Christian Montgomery, Charlotte, aged 62, died February 18 of heart disease.

Continued on page 38

Revelation In Stethoscopes

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With Soft Rubber Contact

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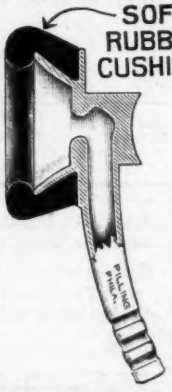

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Continued from page 36

Dr. Richard B. Henderson, Franklin, aged 73, died February 19, the result of a fall.

Dr. James Rufus Gordon, Jamestown, aged 73, died February 20 of cerebral hemorrhage.

Dr. George C. Holland, Dallas, aged 66, died February 4 of uremia.

Dr. Edwin M. Hollingsworth, Mount Airy, aged 65, died February 10.

OKLAHOMA

The tenth quarterly meeting of the Southern Oklahoma Medical Association was held at Ada in March.

Deaths

Dr. William A. Ewing, Washington, aged 68, died December 12.

Dr. Robert X. Wade, Coyle, aged 75, died December 29 of lobar pneumonia.

Dr. Henry Preston Clarke, Tulsa, aged 71, died February 15 of heart disease.

SOUTH CAROLINA

Dr. Kenneth M. Lynch, Charleston, Professor of Pathology, Medical College of the State of South Carolina, and President of the State Medical Association, has written a book, "Protozoan Parasitism of the Alimentary Tract," which is being favorably received by the medical profession, especially by the student and practitioner.

Continued on page 40

Classified Advertisements

SITUATION WANTED — Pediatrician, Harvard trained; general internship and four years' general practice before specializing; Southerner; married; age 32. Now engaged in practice and member of outpatient staff of leading children's hospital in East. Consider group practice; partnership; full-time position. Future must be bright. Prefer South Atlantic states. Reply B. L. J., care of Southern Medical Journal.

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Continued from page 38

The annual meeting of the South Carolina State Medical Association will be held in Greenville May 5-7.

TENNESSEE

Sir W. B. Hardy, Professor in Cambridge University, England, recently delivered a series of lectures at Vanderbilt Medical School.

Dr. W. S. Leathers, Dean of Vanderbilt University Medical School, has been appointed a member of the National Advisory Health Council of the U. S. Public Health Service, announcement being made by Dr. Hugh S. Cumming, Surgeon General.

Dr. G. F. McCleary, of the Ministry of Health in England, spoke at the Vanderbilt University School of Medicine during April, his subject being "The Control of Narcotic Drug Addiction."

Dr. George R. Minot, Professor of Clinical Medicine at Harvard and Director of the Laboratories of the Boston City Hospital, delivered the annual Alpha Omega Alpha lecture at Vanderbilt University School of Medicine.

Dr. Charles R. Stockard, Professor of Anatomy at Cornell Medical School, lectured to the students and faculty at the Vanderbilt University School of Medicine in April.

Greene County Medical Society has elected Dr. C. B. Laughlin, Greeneville, President; and Dr. M. A. Blanton, Mosheim, Secretary.

Humphreys County Medical Society has elected Dr. J. T. Cooley, Waverly, President; Dr. J. A. Sugg, McEwen, Vice-President; and Dr. W. W. Slayden, Waverly, Secretary-Treasurer.

Lincoln County Medical Society has elected Dr. W. S. Joplin, Petersburg, President; Dr. J. M. Shelton, Kelso, Vice-President; and Dr. L. L. Shedden, Fayetteville, Secretary-Treasurer.

Marshall County Medical Society has elected Dr. W. T. Sharp, Farmington, President; Dr. Paul Foster, Lewisburg, Vice-President; and Dr. J. A. Hardison, Lewisburg, Secretary-Treasurer.

Continued on page 42

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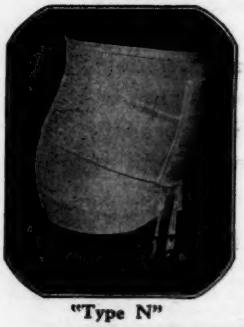

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Continued from page 40

The Doctors' Secretaries' Association recently entertained members of the Memphis and Shelby County Medical and Dental Societies. The program consisted of a symposium on "The Secretary a Doctor Wants."

Hamilton County Medical Society, Chattanooga, recently entertained at dinner in honor of Dr. William Gerry Morgan, Washington, President of the American Medical Association, at which time Dr. Morgan discussed medical problems.

Dr. C. H. Johnson, Lexington, was injured in an auto accident recently.

Mead's Powdered Lactic Acid Milk No. 1 (containing Dextri-Maltose) may be boiled for ten minutes without curdling. While boiling is unnecessary, as the product is practically sterile, it is a feature which removes a hindrance to the physician's technique confronting him in the use of the old type of powdered lactic acid milk which cannot be boiled without curdling. This product never curdles; it is always ready, and quickly reliquefied. No ice is necessary to keep the powder. It is convenient while traveling. Samples and literature sent on request. Mead Johnson and Company, Evansville, Indiana, U.S.A.

Dr. J. J. Ashby, Nashville, has opened offices in the Doctors' Building, practice limited to orthopedic surgery.

Dr. D. W. Smith, Nashville, has opened offices in the Doctors' Building.

Deaths

Dr. Albert A. Greenlee, Dyersburg, aged 55, died January 25.

Dr. L. B. C. Wagner, Knoxville, aged 76, died February 27.

Dr. C. B. Baird, Sharon, aged 66, died January 24 of pneumonia.

TEXAS

Bexar County Medical Association has elected the following officers for 1931: Dr. Rex. R. Ross, San Antonio, President; Dr. Dudley Jackson, San Antonio, Vice-President; Dr. H. O. Wyneken, San Antonio, Secretary; and Dr. E. V. DePew, San Antonio, Treasurer.

Bee County Medical Association has elected the following officers for 1931: Dr. L. L. Griffin, Beeville, President; Dr. Houston Neeley, Beeville, Vice-President; and Dr. Hershall LaForge, George West, Secretary-Treasurer.

Caldwell County Medical Society has elected Dr. Jesse W. Pryor, Luling, President; Dr. T. B. Coopwood, Lockhart, Vice-President; and Dr. H. B. Henry, Luling, Secretary-Treasurer.

Bell County Medical Society elected Dr. G. V. Brindley, Temple, President; Dr. W. A. Chernosky, Temple, Vice-President; and Dr. M. W. Sherwood, Temple, reelected Secretary-Treasurer.

Hutchinson County Medical Society has elected Dr. L. M. Draper, Borger, President; Dr. W. W. Brooks, Borger, Vice-President; and Dr. L. C. Hansen, Borger, reelected Secretary-Treasurer.

Mitchell County Medical Society has reelected to serve for 1931 Dr. Thomas J. Ratliff, Colorado, President; Dr. Charles L. Root, Colorado, Vice-President; and Dr. H. Grady Whitmore, Colorado, Secretary-Treasurer.

Titus County Medical Society has elected Dr. T. S. Grissom, Mt. Pleasant, President; Dr. John M. Ellis, Mt. Pleasant, Vice-President; and Dr. W. A. Taylor, Mt. Pleasant, Secretary-Treasurer.

Wharton-Jackson Counties Medical Society has elected Dr. J. M. Andrews, Wharton, President; Dr. H. V. Reeves, El Campo, Vice-President; and Dr. T. M. Neal, Wharton, Secretary-Treasurer.

Wilbarger County Medical Society has elected Dr. W. G. Carnathan, Rock Crossing, President; Dr. Howard Reger, Vernon, Vice-President; and Dr. T. A. King, Vernon, Secretary-Treasurer.

Young County Medical Society has elected Dr. B. B. Griffin, Graham, President; and Dr. D. E. Winstead, Graham, Secretary-Treasurer.

Tom Green County Medical Society has elected Dr. Brian T. Brown, San Angelo, President; Dr. S. J. Burleson, San Angelo, Vice-President; Dr. J. B. Chaffin, San Angelo, Secretary; and Dr. H. R. Wardlaw, San Angelo, Treasurer.

Dr. J. A. Simpson, Laredo, has been reelected Post Commander of the Frank Earnest Camp 44, United Spanish War Veterans.

Dr. Joseph L. Livingston, Tyler, suffered the complete loss of his office by fire.

Dr. Frances Vanzant, Houston, daughter of Dr. and Mrs. B. T. Vanzant, was awarded a fellowship in the Macy Foundation for research work in the last year in the field of gastroenterology.

Deaths

Dr. Albert Ludwig Mondrick, Bryan, aged 52, died January 22 of influenza and heart disease.

Dr. Tolbert Fanning Yater, Cleburne, aged 55, died February 10 of pneumonia.

Dr. William E. Pennington, Greenville, aged 71, died January 28.

Dr. Horace Curlin Hall, Laredo, aged 57, died February 2 of myocarditis.

Dr. Charles A. R. Campbell, San Antonio, aged 65, died February 20 of septicemia.

Dr. Robert E. B. Bledsoe, McCamey, aged 57, died February 1 of heart disease.

Continued on page 44

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Continued from page 42

Dr. Walter Alva Fletcher, Valley View, aged 40, died February 3 in Gainesville.

VIRGINIA

Dr. S. A. Mitchell, Director of the Leander McCormick Observatory, University of Virginia, gave the Stuart McGuire Lecture at the Medical College of Virginia in Richmond this year.

Dr. Charles R. Robins, Jr., Richmond, has just returned from studying in Vienna, Berlin, Paris and Budapest.

Dr. G. B. Setzler has moved from Norton to Pennington Gap, and is Chief Surgeon of the new Lee General Hospital there.

Dr. A. T. Sheffield has moved from Suffolk to Bluemont.

Dr. John A. Hornsby, Superintendent of the University of Virginia Hospital, was injured in an automobile accident in Washington.

Dr. W. H. Walcott has moved from Clinchburg to East Falls Church.

Dr. R. H. Meade, Jr., has moved from the University of Virginia to Philadelphia, where he has been appointed an Associate in Surgery in the University of Pennsylvania.

Dr. Robert F. Gillespie has moved from Bastian to Switchback, West Virginia, where he is connected with the Pocahontas Fuel Company.

The Virginia Tuberculosis Association has reelected Dr. Dean B. Cole, Richmond, President; Mr. George W. Call, Richmond, Treasurer; Dr. Roy K. Flannagan, Assistant Commissioner of Health, Secretary; Dr. William P. Caton, Fairfax County, First Vice-President; and Mrs. Allen Kirk, Roanoke, Second Vice-President.

Continued on page 46

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Bedside Stand Inhaling Outfits
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Louisville, Kentucky

Continued from page 44

Dr. Louis Perlin, Richmond, and Miss Lillian Levin, Baltimore, were married February 15.

Deaths

Dr. Job Gustave Holland, Holland, aged 69, died February 14.

Dr. William Carey Barker, Buchanan, aged 73, died February 25.

Dr. John Edward Lincoln, Lacey Spring, aged 75, died March 15.

Dr. Moreland Russell Irby, Richmond, aged 54, died March 16 of apoplexy.

Dr. Calvin W. Canan, Orkney Springs, aged 65, was killed in an automobile accident February 28.

Dr. William Hamilton Dulaney, Lynchburg, aged 94, died in March.

Dr. Jefferson Cawood Newman, aged 69, died February 8 of heart disease at National Soldiers' Home.

Dr. A. Kemper Gilmer, Lebanon, aged 57, died February 18 of heart disease and pneumonia.

WEST VIRGINIA

May 12, the birthday of Florence Nightingale, has been set aside by the National Hospital Association as National Hospital Day. Many West Virginia hospitals will take some part in the observance of this day, the purpose of which is to bring to the minds of the lay public the realization of the value of hospital work.

Dr. W. S. Shepherd and Dr. M. L. Dillon, Charleston, have dissolved their partnership. Dr. Shepherd will remain in the old location, 1106 Virginia Avenue, and will be assisted by Dr. Virginia E. Holcombe. Dr. Dillon will be located in the Professional Building.

Dr. Robert F. Gillespie, formerly of Bastian, Virginia, is now connected with the Pocahontas Fuel Company, Switchback.

Summers County Medical Society has elected Dr. Paul A. Ford, Talcott, President; and reelected Dr. A. P. Hudgins, Hinton, Secretary-Treasurer.

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